LABOR, LAW, AND INFORMALITY IN LATIN AMEIRCA: EMPIRICAL ESSAYS

A Thesis

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Master of Science

by

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ABSTRACT

Chapter 1 replicates and extends Khamis (2009) to provide a detailed analysis of informality in the Mexican labor market. The goal is to develop a deeper understanding of factors that drive a Mexican worker to join the informal sector. I utilize the Mexican Family Life Survey (MxFLS) to test the relationship between informality and gender, relationship status, age, place of residence, educational attainment, job type, income, firm size, and violence. I find that younger, unmarried women and men with lower levels of education living in small rural towns and working in the service sector have the highest propensity to work informally. Additionally, formality is concentrated in lower income groups and smaller firms and older, married men that are not in non-service sector jobs tend to work in formal positions regardless of firm size. Finally, I find violent assault experience does not have a significant relationship with working the informal sector.

Chapter 2 expands empirical literature regarding labor law violation and compliance by identifying violation rates for the case of Uruguay. The analysis is then extended using a labor market adaptation of Alkire-Foster multidimensional poverty measurement. I find that labor law violation has progressively decreased since 2002, laborers who have low education, live in rural areas, are black, and work in small firms are more likely to face labor violations, and workers are more likely to experience violations in labor dimensions outside of minimum wage. These findings open a rich research agenda concerning labor law violation rates, enforcement resources, and informality.

BIOGRAPHICAL SKETCH

Born in Uruguay, Joaquin moved to the United States at an early age. He graduated with a BS in Applied Economics from the University of Minnesota – Twin Cities. Passion for international relations and economic development brought him to Cornell University. After completion of the MS degree, Joaquin will move to New York City to work in international business consulting.

This thesis is dedicated to my Dad, Tata, and Chino for providing curiosity and ambition

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INTRODUCTION

> "Labor markets and employment receive relatively little attention in the literature on combating global poverty. In 2000, 189 countries of the United Nations adopted eight millennium development goals: eradicating extreme poverty and hunger; achieving universal primary education; promoting gender equality and empowering women; reducing child mortality; improving maternal health; combating HIV/AIDS, malaria, and other diseases; ensuring environmental sustainability; and developing a global partnership for development. Employment is not one of the eight, though it is a means to many of them." (Fields 2012).

This thesis consists of two empirical essays on Latin American labor markets. In the first chapter, entitled "Determinants of Worker's Propensity to Join the Informal Sector in Mexico," I use individual level data to evaluate the relationship between worker characteristics and informality in Mexico. Workers that are not self-employed and receive legally mandated social security make up the formal sector and Mexican workers that are not self-employed and don't receive social security make up the informal sector. I use probit models to evaluate how age, educational attainment, relationship status, place of residence, job type, experience of violent assault, and income affect an individual's propensity to join the informal sector. In the second chapter, entitled "Labor Law Violations in Uruguay," I use individual level data to conduct a multidimensional analysis of labor law violation occurrence in Uruguay. Six labor laws are considered: minimum wage, weekly work hours, yearly bonus, social security, vacation time, and overtime pay. I measure headcount ratios for all forms of violation and I analyze depth of occurrence using the Bhorat et al (2012) method and the Alkire-Foster method (Alkire and Foster 2011) The results from the two studies contribute to the Mexican, Uruguayan, and Latin American empirical labor literatures.

Fields (2012) explains that "most of the world's poor are poor because they work hard but their work does not bring in enough income for them to be able to escape poverty." The motivation for this thesis is improving the quality of employment opportunities for poor workers. I do not recommend strategies for policy implementation, but I hope to provide information that helps policymakers support institutions that incentivize high quality employment. Acemoglu, Johnson, and Robinson (2005) argue that differences in economic institutions are the fundamental cause of differences in economic development because institutions "shape the incentives of key economic actors in society." Quality of employment hinges on two key economic actors: workers and firms. Firms must have the resources to pay competitive wages and workers must have capital to perform in competitive positions. The findings on informality and labor market violations in this thesis identify disadvantaged workers in Mexico and Uruguay that fall outside the ambit of institutional regulation.

The essays in chapters 1 and 2 are empirical studies that utilize household level surveys. Empirical findings are crucial to development economics because policy contexts differ between countries (Meier 2005). Development policies based on theory but designed without consideration of country context, such as structural adjustment in the 1970's and 1980's, are ineffective (Schatz 1994). Empirical economics fills the gap between economic theory and observed data, helping lawmakers adapt policy to regional contexts. Empirical research in development economics has grown considerably in recent decades through expanded data availability, introduction of new econometric techniques, and influential publications (Banerjee and Duflo 2012). Additionally, empirical analysis is more common and relies on more diverse sources of data in labor economics than in economics more generally (Angrist and Krueger 1999).

Although chapters 1 and 2 both provide analysis on disadvantaged workers in Latin America, they examine different labor market concepts using different methodologies. In Chapter 1, I am interested in how certain variables determine an individual's propensity for joining the informal sector, while in Chapter 2, I am interested in measuring occurrence and depth of occurrence of labor law violation.

Chapter 1 is an extension of the work in Khamis (2009), who studies four dimensions of informality in the Mexican labor market. She finds that "various legal measures of informality, whether the individual is covered by social security or has a written contract in the current job or in the previous job, are significantly correlated." She also runs basic probit models relating education level, age, gender, and relationship status to each definition of informality. My approach for Chapter 1 is to extend analysis of the probit models for only the legalistic social security definition of informality. Chapter 1 relies on econometric techniques and focuses on how coefficient values and standard errors change depending on model specification. Instrumental variables regression is used to address the endogeneity in the violent assault variable.

Chapter 2 is a multidimensional analysis of labor law violation. Instead of relying on econometric technique, the analysis in chapter two uses two specification methodologies to analyze the breadth and depth of labor law violation in Uruguay. The Bhorat et al (2012) methodology measures depth of minimum wage violation and the Alkire-Foster methodology measures breadth and depth of violation across multiple labor laws. I apply these methodologies to various groups of individuals categorized by race, education level, income, and job type to compare differences in violation rates. A simple probit model provides correlative evidence, but the focus of the chapter is on describing occurrence of labor law violation.

CHAPTER 1

Introduction

The informal sector is a subset of jobs that can be characterized by lack of administrative oversight, ease of entry, small scale of operation, labor-intensiveness, family based operation, and low skill (Fields 1990). In the 1970's, economic researchers considered the informal sector a second-choice option with segmented wages strictly lower than the urban formal wage. Throughout the 1980's and 1990's, qualitative research showed that informal labor markets are complex, centrally important elements of Less Developed Country (LDC) economies. Modern studies take the perspective that the informal sector consists primarily of lower-quality jobs, but can also be a rational and sometimes lucrative option for workers and firms in LDC countries. In the words of Maloney, "we should think of the informal sector as the unregulated, developing country analogue of the voluntary entrepreneurial small firm sector found in advanced countries, rather than a residual comprised of disadvantaged, workers rationed out of good jobs" (Maloney 2004).

Conceptualizing the informal labor market as a dynamic sector allows research to reflect the realities of LDC's more effectively, but also presents empirical and theoretical challenges for researchers. The result is a contentious body of literature with disparate and often contradictive findings on the definition and economic implications of the informal sector. Empirical labor market research is imperative, as it tailors informality to reflect specific features of a country and allows researchers to shed light on the conceptual debate.

This chapter contributes to informality research by identifying demographic and labor market characteristics that affect a Mexican worker's propensity to join the informal sector. Informality is defined using the legalistic definition as suggested by Levy (2008). Three research questions are addressed in this study:

1. How does educational attainment, relationship status, geographical location, and job type determine propensity to join the informal sector for men and women in Mexico?
2. Does the relationship between these worker characteristics and informality vary across income levels and across firm size?
3. Is there a relationship between violent assault and participation in the informal market?

Questions 1 and 2 evaluate education, relationship status, geographical location, and job type for all Mexican workers and for workers grouped into income and firm size categories. The research topics explored in these questions have been addressed in the informality literature (Gasparini and Tornaroli 2009; Khamis 2009). These studies will be covered thoroughly in the literature review. Based on the informality literature, I expect high educational attainment, working age, marriage, urban residence, and white collar jobs to be correlated to formality and low educational attainment, single status, rural residence, and service jobs to be correlated to informality. On the other hand, the relationship between violence and informality is unexplored in the informality literature. Relevant studies relating violent crime to labor marker outcomes is discussed in the literature review, along with a discussion of expected results.

Literature

The purpose of this literature review is to give theoretical and empirical foundation to carry out the analysis. The first section clarifies the historical conceptualization of informality and contextualizes its theoretical place in modern labor market literature. The second section discusses informality in Mexico and the relationship between worker characteristics and informality. The insights will help determine the empirical strategy used to create our dependent variable and provide a foundation to compare explanatory variable results.

Informality: Origins, Interpretations, and Relevance

Origins

Informal sector models originate from dualistic labor market models, which distinguish between a "formal, modern, or capitalist" sector and an "informal, traditional, or agricultural" sector (Fields 2005). For the purposes of this thesis, I will refer to the sectors in dualistic models as the "urban" sector and the "rural" sector. The introduction of two sector models was important for development research because they aptly describe rural-urban wage segmentation and are better at accounting for income differences across the sectors in LDC's (Lewis 1954; Kuznets 1955; Dixit 1973). It is important to note that two-sector theoretical models do not give definite prescriptions about labor markets, but are tools researchers use to understand labor markets. The Harris-Todaro model (H-T) is a dual-sector framework that revolutionized two-sector labor market analysis in LDCs and eventually enabled the introduction of an informal sector (Harris and Todaro 1970). Fields (2007) qualifies the immense impact of H-T on LDC research by identifying two mistakes it helps policymakers avoid: "One is to assume that

development efforts should necessarily be channeled to the sectors where the poor are. The other is to assume that efforts should necessarily be focused on getting the poor out of the sectors in which they now are."

The fundamental insight of Harris-Todaro is that urban unemployment increases when an abundance of rural workers migrate to the urban sector in search of modern, high-wage jobs (Todaro 1969; Harris and Todaro 1970). Between 1950 and 1960, demographic shifts were happening in the developing world. Rural laborers were migrating to cities and urban labor markets were unable to absorb all of the incoming workers. This presented governments of LDC's with a paradox: why do rural workers migrate to urban centers that have high unemployment and swell the size of urban slums? To answer this question, Harris and Todaro studied the Tripartite Agreement, a Kenyan policy designed to decrease burgeoning unemployment. The logic behind the policy was simple: if public and private firms agreed to increase hiring and unions agreed to fix wages at the current rate, jobs would be created for unemployed urban workers. Instead of decreasing unemployment, the policy caused simultaneous increases in urban migration and unemployment. Harris and Todaro justified this outcome by postulating that, in a labor market that features a low wage rural sector and a high-fixed-wage urban sector, the number of rural workers who migrate to seek higher wages is greater than the number of jobs available in the urban sector. The outcome of the Tripartite agreement is justified when this logic is applied; adding jobs at a constant wage will incentivize disproportionate migration and cause unemployment to grow even higher.

The key mechanism driving unemployment in the H-T model is wage difference. The outcome is migration, which "proceeds in response to urban-rural differences in expected

earnings with the urban employment rate acting as the equilibrating force on migration." In a standard two-sector labor market workers will migrate to the higher wage sector until the wages converge and laborers are left without incentive to migrate. In this case, the labor market reaches equilibrium at a labor market clearing rate. In this standard case, wage dictates incentives and unemployment remains in check. H-T reaches equilibrium when rural wage and *the expectation of urban wage* converge:

$$W_r = W_{ue} = \frac{N_u}{N_{lf}} * W_u$$

W_r = Rural wage; W_{ue}= Urban Expected Wage; W_u= Urban Wage

N_{emp}= laborers employed in the urban sector; N_{lf}= urban labor force

A summary of the model is offered in the Harris-Todaro paper: "the [rural and urban] sectors are intimately connected through labor migration. If one additional job is created in the [urban] sector at the minimum wage, the expected wage will rise and rural-urban migration will be induced."

Studies published shortly after H-T argued that urban jobs outside of the minimum wage urban sector existed (Lopez 1970) and the concept of an informal sector that is comprised of these jobs was introduced to the literature by Keith Hart (1972). Fields established the informal sector formally by incorporating a secondary market for workers unable to find urban sector jobs, which he called a "murky" sector, that featured the following attributes: free entry, income-sharing, and on-the-job search opportunities. The third attribute is a key mechanism that

incentivizes workers to remain in the urban sector. Workers explore other employment options and many end up "underemployed." If workers can participate in the informal sector and continue to search for formal jobs with a reasonable probability of success, workers have additional reason to remain in urban areas. Under Field's specification, a new equilibrium condition is reached that allows for both formal and informal jobs to be available to urban migrants:

$$W_r = W_{ue} = \frac{N_u}{N_{lf}} * W_u + \frac{N_i}{N_{lf}} * W_i$$

Throughout the 1980's and 1990's, informality in the labor market was primarily analyzed through this lens and this "urban informal sector."

Interpretations

The urban informal sector took an important role in development and labor market research soon after its introduction. Economists understood that rural people migrate to urban areas for formal work and stay in urban areas even if they cannot find a formal sector job. Those who stay are forced to make a living in the urban informal sector as they search for formal work. This interpretation was theoretically convenient, but many critics noted that it fails to reflect the job market realities in developing countries (Hart 1973; Bienefeld and Godfrey 1975). In a pointed critique, Peattie (1987) sums up the disconnect between development research and the concept of informality: "The 'informal sector,' however defined, is not necessarily a category within which to locate the poor. There are well-to-do petty entrepreneurs, and workers underpaid by large enterprise… This idea is at least debatable and I believe should be debated, rather than

incorporated into our thinking by looking at poverty only within very small firms and by looking at only poor small-scale producers and entrepreneurs." Assuming a homogenous and undesirable alternative to the formal sector was no longer enough; for informality research to be relevant to public policy, the scope of the urban informal sector had to be expanded.

In response, Fields (1990) revisits the 1975 paper and incorporated the criticisms, pushing urban informal market analysis into its modern form. The key criticism Fields (1990) cites is from Tokman (1988), who explains that differentiation is an important feature of the informal sector, as some workers come into the informal sector with capital endowments and work jobs that have barriers to entry. Fields steps away from the urban informal sector definition and concludes a non-homogenous informal labor market is more suitable. His revelation prompted the modern informality research agenda, where economists seek to understand a dynamic informal sector that is not exclusively suboptimal, varies depending on the economy being studied, and comprises an important and often persistent part of developing economy labor markets.

A dynamic informal sector is advantageous over a wage-segmented "urban informal sector" because it more closely represents economic reality, but conceptual ambiguity has led to divergent and contradictory ideologies within the literature. Once again, Peattie (1987) explains: "Since [informality] is so impossible to define, it is naturally impossible to bound in a real world where data is to be gathered… it is by definition going to be rather out of the reach of measurement." Peattie's criticism foresaw the challenges faced by economists to measure informality. Definitions used in mainstream labor literature can be grouped into two categories: productive and legalistic. Khamis (2009) discusses both and finds correlations between the definitions in the Mexican labor market. She also defines dependent variables using both

definitions and finds similarity in worker characteristics across the definitions. In this thesis, I focus specifically on the legalistic definition because of empirical implications and relevance to the Mexican context. Since the legalistic measurement strategy is closely tied to government institutions, policy conclusions, often revolving around regulation and enforcement of labor law, are more applicable than they are under the abstract productivity definition. Kanbur (2009) emphasizes the role of enforcement within the legalistic definition, explaining that firms, on the supply-side of labor, have four possible reactions to the legal enforcement of a labor law: compliance within the ambit of regulation, non-compliance within the ambit of regulation, exit the ambit of regulation, and never entering the ambit in the first place. Our paper takes the perspective of the worker, the demand-side of the labor market. Using Kanbur's framework, Mexican workers operate in a labor market where jobs can be formal or informal in various firm styles and can receive livable wages outside of the regulatory structure.

Informality and Poverty

Despite conceptual ambiguity surrounding informality, there is consensus that this large, semi-legal, urban, and underproductive workforce exists in many developing countries and is closely tied to urban poverty (Sethuraman 1981, 1997; Maloney 2004). Informality research is important because it provides insight for governments, development agencies, and non-profits that seek to eradicate poverty through development of labor markets. Studies relating poverty to informality focuses on income inequality, social protection, and migration. Although research shows the informal sector is not segmented and wages in the informal and formal sector do overlap, formal jobs are more likely to be a direct path out of poverty in most countries (Maloney 1999; Arias and Khamis 2007; Bargain and Kwenda 2010). Formal work, defined by

the legalistic view, provides access to social support programs, stable employee-employer relationships, and opportunities to accumulate capital in the form of labor. Additionally, formalization helps governments expand the tax base and social programs.

Wage heterogeneity between the formal and informal sectors adds difficulty when trying to identify a relationship between informality and poverty. As Maloney (2004) suggests, it is societally advantageous to support certain firms and laborers that operate in the informal sector so they can eventually enter the formal sector. Observing worker characteristics that raise or lower propensity to join the informal sector offers an alternative method to wage for differentiating between the formal and informal sectors.

Informality and its Determinants

Theoretical informality research from the previous section is complemented by a review of empirical literature in two sections. First, literature that defines the Mexican informal worker will help construct the dependent variable for the econometric models. Second, a review of studies on the inverse relationship between informality and worker characteristics, with particular attention given to Mexico and Latin America, will provide a baseline for comparison of results.

Mexican Context

Levy (2008) offers strategies for measuring the Mexican informal sector and studies the impact of social programs on labor segmentation. This study will use Levy (2008) as a guideline to measure the Mexican informal sector. Accordingly, this section of the literature review presents Levy's specification of the Mexican informal sector, along with alternative definitions, to form an initial identification strategy for measuring the informal sector.

Levy (2008) defines formal Mexican workers using the legalistic definition as "salaried workers employed by a firm that registers them with IMSS." The Mexican Social Security institute (IMSS) is Mexico's social security bundle that includes health insurance, disability insurance, work-risk insurance, life insurance, day care for worker's children, sports and cultural facilities, retirement pensions, and housing loans. Employees that receive Mexican law states that social security is the right of the salaried employee and firms are required to provide IMSS for salaried employment. Employees that receive social security from the Institute for Social Security and Services for State Workers (ISSSTE) are also counted as formal workers. ISSSTE is the government equivalent of IMSS.

An important distinction is that Levy does not claim this is the correct definition of informality and agrees with the idea that there is no uniform definition of the informal market (Guha-Khasnobis, Kanbur, and Ostrom 2006). Informality describes a dichotomy and the definition of informality depends on the constraints of that labor market. Levy suggests that using IMSS to define legalistic informality is most appropriate "in the sense of being driven by the country's laws and institutions pertaining to the labor market." Other definitions for the Mexican informal sector include the productivity and legalistic definitions used in Khamis (2009). She finds strong correlations between the different informality definitions and similarities between the definitions in terms of their relationship with worker characteristics. Alternative definitions are not considered in this thesis.

Relevant Variables

The final section of the literature review addresses the relationships between worker characteristics and the informal sector. Generally, informality studies find that Mexico has a large

and highly heterogenous informal labor market that has gradually decreased in size since the Mexican credit crisis.

Gasparini and Tornaroli (2009) conduct a comparative study of informality across Latin America. For the case of Mexico, they use Encuesta Nacional de Ingresos y Gastos (ENIGH) between 1992 and 2002 and classify Mexican workers as informal if they have a pension when retired. The authors show that informal workers in Mexico comprise over half of the labor market and are correlated with lower levels of education, older and younger age groups, and employment in small firms. Mexico is one of two Latin American countries that experience an overall decrease in informality between 1990 and 2002, but is similar to other Latin American countries in terms of worker characteristics associated with informality.

Workers with low levels of education have higher propensities to join the informal sector in developing economies (Maloney 2004; Gasparini and Tornaroli 2009; Herrera-Idarraga 2016) and in Mexico (Maloney 1999). This result coincides with studies that show the informal sector is occupied by a large proportion of low-skill, low-income workers, as these workers tend to have lower levels of education. Workers with high educational attainment are more likely to avoid the informal sector because they can compete for high-wage jobs in the formal sector. Gunther (2006) uses Ivorian data to show that the formal and informal sectors overlap not only in terms of wage, but also exists in terms of educational attainment. This shows that "upper tier" jobs in the informal sector offer higher wages, but also require initial levels of human capital to acquire the job. The consensus in this area of research is that education is correlated with formality status, but there is no exclusivity in terms of education attainment in the informal sector. This study analyzes how educational attainment changes propensity to join the informal sector and

contributes to the literature by describing this relationship for Mexico and exploring the depth of overlap in educational attainment between the formal and informal sectors.

The relationship between violent crime and informality is not addressed in labor market literature. Depending on how this relationship is framed, different outcomes can be justified. For example, formal individuals may be more likely to experience a violent crime because formal jobs tend to be offered in urban areas, where both formal jobs and violent crimes are more common. Additionally, violent crime experiences may incentivize individuals to make more conservative decisions, such as acquiring a formal job that offers social security. On the other hand, individuals in the informal sector tend to be poorer than those in the formal sector and likely are unable to afford safe neighborhoods, exposing them to crime. My motivation is to find evidence of a relationship between violent crime and informality in Mexico, a country with relatively high violence rates strongly correlated to escalating drug activity (Verdugo-Yepes, Pedroni, and Hu 2015). To conduct the analysis, I take advantage of individual victimization data provided in the MxFLS surveys.

The labor market literature links violent crime to a reduction in work, reduction in consumption, and reduction in educational attainment (Lloyd 1997; Freeman 1991). BenYishay et al (2013) study the impact of increasing homicide rates on labor force participation in Mexico. The authors use a fixed effects model with instrumental variables to show that victims of violent crime work see a 1-2% reduction in hours worked and an increase of 10 homicides per 100,000 over a one year leads to an average decline of approximately 0.29 hours worked per week among all individuals. There is no research on the consequences of violence on employment decisions in Mexico or elsewhere, but based on the findings in BenYishay et al (2013), I expect experience

of violent crime to be associated with lower rates of informality. It is important to note that Levitt (1997) addresses endogeneities in the relationship between crime and police presence. I address endogeneity in the relationship between violent crime and informality with an instrumental variable regression.

Data and Methodology

Data

The data for this study comes from the Mexican Family Life Survey (MxFLS), which was collected in three series (MxFLS-1, MxFLS-2, and MxFLS-3) and is jointly managed by Iberoamerican University (UIA), the Center for Economic Research and Teaching (CIDE), and Duke University. The MxFLS is a nationally representative survey and includes specific information at both national and regional levels. It is a longitudinal panel that follows individuals over time. Each series contains detailed statistics regarding topics such as education, employment, income sources, health, and crime, as well as other descriptive characteristics on an individual and household basis. The data also incorporates detailed information covering various features of the labor market.

This study extends the data used in Khamis (2009) by including all 3 MxFLS datasets, changing data specifications on three variables used in Khamis (2009), and incorporating new variables. While leveraging all three datasets adds breadth, it is important to note differences between the survey editions that limit the study. MxFLS-1 was conducted entirely in 2002, MxFLS-2 started in 2005 and ended in 2006, and MxFLS-3 started in 2009 and ended in 2012. The MxFLS website cites the re-contact process as the main source of time lag for the MxFLS-2 and MxFLS-3 series.

Additionally, the surveys allow for changes in household composition. If a new member joins a household, she or he is added to the dataset. The two changes can cause correlations within groups of individuals with similar response times and correlations within the group of individuals that are added. I do not attempt to measure the impact of these limitations. Analyses using MxFLS-2 and MxFLS-3 will treat the surveys as representative of the conduction time span instead of a specific year.

The formal sector in Khamis (2009) is defined as non-agriculture workers that receive IMSS and the informal sector as non-agriculture workers that do not receive IMSS. The specification used in this study is changed to exclude workers that earn ISSSTE, the public-sector equivalent of IMSS, from the informal labor market. The social security dimension of informality used in this paper defines the formal sector as non-agricultural workers that receive either IMSS or ISSSTE and the informal sector as non-agriculture workers that do not receive IMSS or ISSSTE. Observations considered informal under the original specification shift to the formal sector under the new definition.

The explanatory variables used in this study comprise of the variables in Khamis (2009) (gender, household heads, relationship status, state of residence, age, and education level) and new variables (urban or rural residence, victimization rates, and job type). As mentioned in the literature review, the new variables have not been included in previous studies. Additionally, the informality, education, and job sector variables are defined with new methodology. Changes to Khamis' original specifications were possible thanks to the author, who kindly shared her data creation process.

The education variable is changed to account for final year of schooling completed and to include two new education categories. Khamis (2009) assigns individuals one of four education categories: *No education*, *Primary education*, *Secondary education*, and *Tertiary education*. These categories represent the final level of education attended by an individual. Therefore, someone that completed high school would be assigned to the same education category as someone who failed to complete the first year of high school. This study uses five education categories: *Less than Elementary*, *Elementary*, *Middle School*, *High School*, and *Tertiary*. The categories represent the highest level of education completed by an individual, instead of highest level of education attended. *Middle* and *High School* combine to form the *Secondary* category in the original specification. *Middle* includes individuals who completed up to middle school (9^{th} grade) and the *High School* includes individuals who completed all 12 years of secondary school. The third and final difference is a change in the categorical job sector variable that defines it using the Instituto Nacional de Estadistica y Geographia's (INEGI) Mexican Classification of Occupations. This keeps consistency between all three years of data, as the 2009 survey only provides the Mexican system.

Three new variables are introduced to this study: *urban*, *assault*, and *firm size*. *Urban* is an indicator variable that assigns individuals as urban or rural residents based on the specification used in Haisken-DeNew and Michaelson (2011). An individual is considered rural if he or she lives in a town with a population of less than 12,500. *Assault* is an indicator variable that measures if an individual has ever experienced violent assault. The survey question used to create *assault* changes from "have you ever experienced violent assault?" in MxFLS-1 to "have you experienced violent assault in the past 5 years in?" MxFLS-2 and MxFLS-3. Therefore, *assault* can only be used

with MxFLS-1. *Firm size* is a collection of four indicator variables that account for the number of coworkers at an individual's firm. Finally, an income variable is used to stratify models in Table 7. The three income group variables stratify individuals into lower, middle, and upper third of income earners depending on the individual's income. Income value calculation considers both take home pay and monetary value of alternative compensation

Methodology

Propensity to join the informal sector is examined using a probit model, which is estimated using least squares. The dependent variable for all models in this paper takes a binary value, 1 if the individual is formal and 0 if the individual is informal. The explanatory variables can be binary or continuous. Correlation between the dependent and an explanatory variable implies that, when the explanatory variable changes in value, the probability that the dependent variable is 1 increases or decreases. The probit model was selected over its comparable alternative, logit. Differences between probit and logit models lie in the distribution of error terms and the link function used to calculate probability. Logit models assume standard logistic distribution of the errors, whereas probit models assume errors are normally distributed. Probit link functions model random effects with large medium to large datasets more efficiently and logit link functions perform better in the case of extreme independent variables (Hahn and Soyer 2005). Because there is no reason to assume non-normal errors, there are no extreme independent variables, and the MxFLS data is relatively large, the probit model is best suited for estimation of propensity to join the informal sector. The basic specification is as follows:

$$E(Y_i) = \alpha + \beta_a x_{ai} + \delta_{bg} y_{bgi} + e_i$$

Individual i receives a value of x_{ai} for variable a and the coefficient estimate for variable a is β_a. δ_{bg} represents the group variable, where b identifies the group, either education or job type, and b identifies the variables within the group. Individuals are assigned value y_{bgi} for only one of t variables in δ_{bg}. In the extensions section, this same framework is applied to different partitions of data. For the income extension, the model is applied to the lowest, middle, and upper tiers of income and for the firm size extensions, the model is applied to small, medium, and large firm workers. The instrumental variable methodology is elaborated in the violence extension.

Summary Stats

Summary statistics covering the variables of interest are presented in the appendix for all three versions of the MxFLS survey. Variable means and observations for the employed non-agricultural labor force, the subset of formal laborers, and the subset of informal laborers are provided along with results from difference in means tests between the informal and formal subset. Analysis of the summary tables helps frame the analysis and understand limitations presented by the datasets.

There are more informal workers than there are formal workers in all three MxFLS versions. The difference diminishes over time. In MxFLS-1, 32.5 % of workers are considered formal, compared to 35.4% in MxFLS-2 and 40.2% in MxFLS-3. IMSS and ISSSTE enrollment rates between 2002 and 2012, as reported by the Instituto Nacional de Estadistica y Geografia (INEGI), fluctuate around 50% of the Mexican population.[1] INEGI uses the entire Mexican population to calculate

[1] Based on author's calculations using INEGI website

enrollment figures, whereas the population for this study is comprised of only the employed non-agricultural workforce. The larger total enrollment rates reported by INEGI can be attributed to dependents, who receive social security but are not part of the employed workforce. The enrollment growth discrepancy is less discernable. Demographic shifts, such as a relative decrease in total offspring among formal workers compared to informal workers, can explain how the employed workforce could see increasing social security enrollment rates while the general population retains constant enrollment rates. MxFLS survey technique and population changes could also account for the discrepancy. For the purposes of this study, informality decreased (social security enrollment rates among employed non-agricultural workers increased) between MxFLS-1 and MxFLS-3.

Female workers consistently make up about 38 % of the non-agriculture employed workforce. No significant difference exists between the proportion of women in the informal sector and the proportion of women in the formal sector in any of the survey editions. In this data, women participate in the informal sector at a lower rate than men, although differences may exist within subsets of the female workforce. Household head fall from 44.3% of the labor force in MxFLS-1 to 37.6% of the labor force in MxFLS-3. The mean for household head in MxFLS-3 is 40.2% if only original survey subjects are considered, which shows that the steepness of the decrease can partly be attributed to the nature of the dataset. For example, a household with three school aged children in 2002 may become a household with three young workers between 2009 and 2012. This would add disproportionate amount of non-household head workers to the labor force subsample I created. Additionally, if a household member that was considered dependent in MxFLS-1 becomes head of a new household at the time of MxFLS-3, all members of the new

household are included in the survey. Again, a disproportionate amount of non-household head workers could populate the subsample.

All three survey years show a significantly larger proportion of household heads in the formal sector than the informal sector. The difference is reasonable because social security coverage applies to partners and dependents, making the value of a job that offers social security higher to a household head than a non-household head. Non-household heads have less incentive to find a job that provides social security if the household head already provides social security coverage for the household. Around 45% of married workers participate in the formal sector with little difference between the survey editions. All three surveys show that a significantly higher proportion of married workers participate in the formal sector than the informal sector. The difference could be attributed to age and household head status, as married workers are more likely to be older and heads of household than unmarried workers. There are other dimensions of this difference, such as the previously stated argument that marriage could grant a previously uncovered worker social security through a spouse, de-incentivizing the married person to join the formal sector.

An individual is considered non-urban if he or she lives in a community with a population of 12,500 or less. 72.3% and 72.9% of non-agricultural workers lived in urban areas in 2002 and 2005, but the proportion drops to 62.7% of non-agricultural workers in the MxFLS-3 data. A potential reason behind this steep decrease is migration. If firms in rural areas expanded hiring, the relatively large number of jobs could attract workers. Alternatively, and possibly more plausible, explanations for the decrease include higher response rates among individuals in rural areas or demographic shifts among age groups, such as older workers choosing less stressful rural

residences as they edge closer to retirement. Difference in means tests show that a significantly larger proportion of informal workers live in rural areas. 17.1% of individuals in MxFLS-1 experienced a violent assault and 11.2% of individuals experienced a violent assault in MxFLS-2. Formal workers were significantly more likely to experience a violent assault than informal workers in both surveys. Reasons behind this difference are ambiguous and will be explored in the results section.

Age and income are continuous variables and education and job type are categorical variables. All four are presented as groups of dummy variables in the summary statistics chart and only age is used in its original form in the probit models. For these grouped variables, individuals receive a 1 value if they belong to a subcategory within a group and can belong to only one subcategory. The informal workforce is concentrated in the lower age categories, while the formal workforce is concentrated in the middle age categories. Informal and formal workers at the end of their careers to not show significant means. Differences in education levels between formal and informal workers tend to exist at the lower and higher education levels. There is no significant difference in means between workers who have completed middle school. Income is grouped into three quantiles, so the groups are relatively similar in size. Informal workers are concentrated in the lower and middle income quantiles, while formal workers make up an overwhelming majority of the upper income quantile. The differences in income shown in the summary statistics charts are in accordance with the income differences suggested in the literature. Finally, Informal workers tend to be concentrated in firms of 5 employees or less, while formal workers are concentrated in larger firms. 60% of workers belong to small firms, while only 11% of workers belong to firms with 51 or more employees. There is a substantial inconsistency

between the job type variables in MxFLS-3 and the job type variables in MxFLS-1 and MxFLS-2. Data documentation from the MxFLS website shows that over 2,000 additional workers are included in the "administrative" and "office professional" job categories, both corresponding to the white collar subset of job type. I am unsure why this discrepancy exists, but it does not results comparison of job type between MxFLS-3 and the other surveys. In MxFLS-1 and MxFLS-2, mean of blue collar workers is not different between formal and informal, while white collar has a larger proportion of formal workers and service has a larger proportion of informal workers.

Results

Results from the empirical analysis are presented in three sections. A three-step extension of Khamis for all three versions of the MxFLS survey is carried out to develop the final model.

Replication

Table 4 displays results from the social security dimension probit model in Khamis (2009) alongside replications of the Khamis model for all three series of the MxFLS. data for the replications uses adjusted formality and sector variables. Replication 2005 further reinforces the Khamis 2005 results by decreasing standard errors and finding similar and marginally more precise coefficient values. Changes occur from reassignment of government social security earners from the informal sector to the formal sector in the adjusted data. Standard errors improve because the dependent variable in the new dataset is defined with more precision. The effect of *elementary* is dampened because most the newly formal government workers have above elementary education and the effect of *tertiary* increases because many of the government workers have college or graduate level degrees. Government workers are likely to

be more capable than the average worker, so the effect of ability increases as well. The 2002 and 2009 replications also reinforce the findings in Khamis (2009) with minor differences. In the 2002 model, relationship status has no discernable effect while being the head of household is correlated with formal sector participation. In the 2009 model, single workers are likely to be in the informal sector and *elementary* has no discernible effect while the coefficient on *tertiary* increases significantly. Results from this replication exercise strengthen the findings in Khamis (2009) and prompt the proceeding extensions.

Extension

Three groups of three models, one group for each MxFLS survey, are presented in Table 5 of the appendix. The models *Model A*, *Model B*, and *Model C* are steps in the process of transforming the probit model in Khamis (2009) into the final model for this study. The final model is presented in Table 6.

Model A

In *Model A* variables for ability, single, and divorced are removed, variable age squared is added, and education is controlled for with the redefined set of indicator variables. Khamis (2009) uses a continuous variable to account for age and the result can be interpreted as each additional year of life marginally raises propensity to join the formal sector. Summary tables 1 – 3 show that the youngest and oldest age subgroups to be most susceptible to being part of the informal sector, meaning the relationship between an additional year of life and formality for a 50-year-old worker should be negative. The age squared variable captures concentration of informality at the tails of the age distribution; propensity to be formal increases more each additional year due to the higher coefficient value on *age*, but the negative effect of *agesq* become more severe

with age. Variables *single* and *divorced* are removed because they lack a relationship with informality, leaving *Married* as the sole significant relationship statues variable.

The education variables in *Model A* utilize the specifications described in the data section. The base variable is *middle* because workers that completed middle school comprise the largest education group (35.8% in MxFLS-2). Across all three editions, the *Less Than* and *Elementary* variables have negative coefficients and are highly significant. Workers that do not complete elementary school are least likely to acquire a formal sector job; completion of elementary school raises this likelihood significantly. The difference in coefficient value between *Less than* and *Elementary* is larger in both MxFLS 1 and 2 than it is in MxFLS-3. *High School* is positive and significant across all three models and the coefficient increases in value for each consecutive MxFLS edition. A worker that completes high school is more likely to join the formal sector than a worker who only completes middle school. Interestingly, the College variable has an ambiguous effect in MxFLS-1 and MxFLS-2. This could be the result of informal jobs that require skills and pay well, but avoid regulation. High income earners with college education may also be avoiding government sanctioned social security in favor of private insurance that provides better coverage. It is important to note that the education variables are endogenous in this model. Educational attainment is often correlated with unobserved variation in the error term, such as skill, income, and access to education. This paper is not focused on addressing these endogeneities.

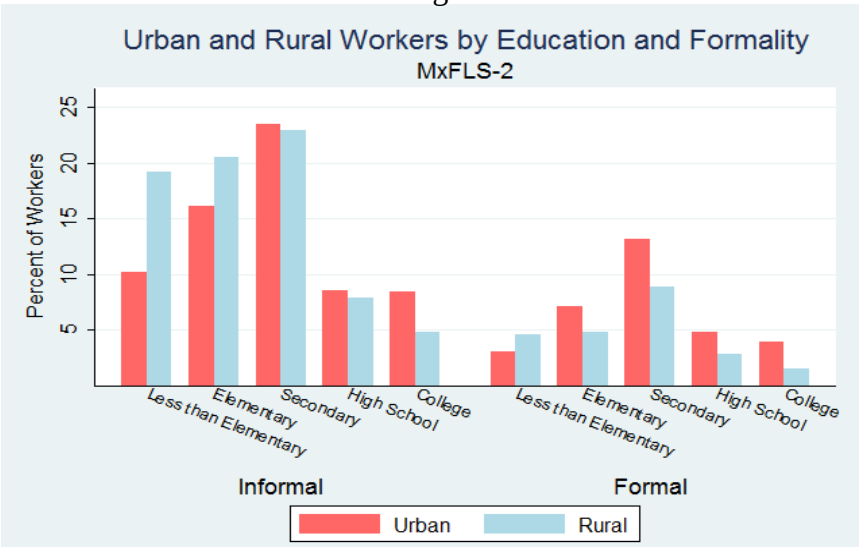
Model B

In *Model B,* the variable *urban* is introduced to account for rural-urban differences and the state control is changed from a continuous variable to a set of indicator variables. *Urban* is

positive and highly significant in all three editions of the MxFLS, suggesting workers in rural areas are more likely to participate in the informal sector than workers in urban areas. In addition to differences discussed in the summary statistics section, there is a body of literature relating lack of enforcement infrastructure to increased labor law violation (Kanbur 2009). Stricter enforcement of social security law in urban areas is a potential differentiating factor.

Controlling for rural-urban differences addresses bias in other explanatory variables. For example, coefficient estimates for *Less than* and *Elementary* become more positive when *urban* is included because *Less than* and *Elementary* capture the effect from disproportionate informality rates among rural workers with low levels of education. To clarify, Graph 1 shows the distribution of workers across education level and formality status. In the "Informal" section, the *Less than Elementary* and *Elementary* bars are much larger for rural workers than they are for urban workers. When we don't control for urban residence, the negative effect of living in a rural area is captured by the less *Less than* and *Elementary* variables because rural residence and low levels of education are strongly correlated. It is important to note that Table 5 shows that *Less*

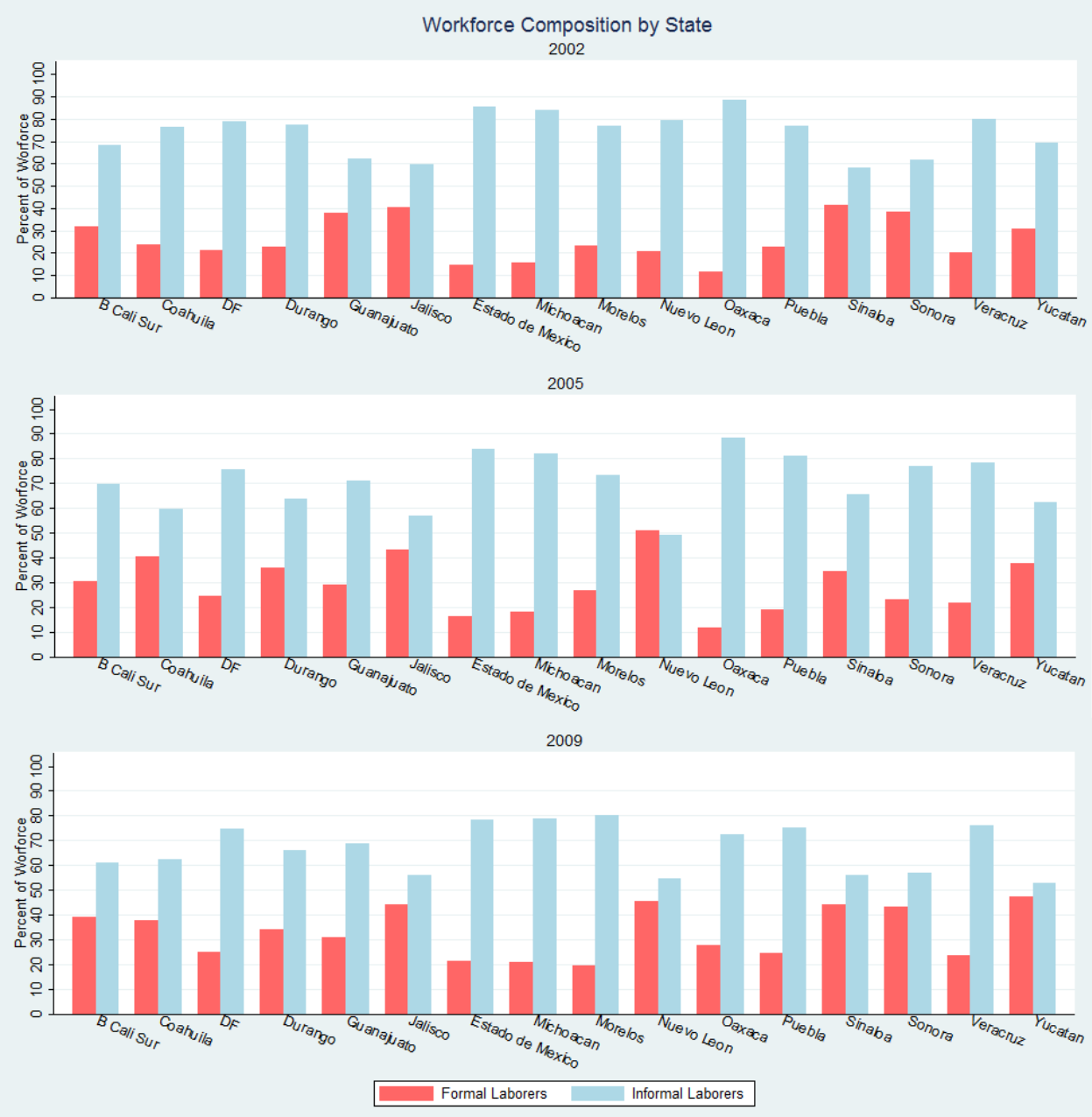
Figure 1



than and *Elementary* become more negative in the *Model B* specification, but this decrease is caused by changing methodology for the state control.

The variable controlling for state of residence is changed from a continuous variable to dummy variables for each state to allow for more specific control of between-state differences. The results are not included in the model because one-by-one discussion of the coefficients and standard errors for these indicator variables would be cumbersome and unnecessary. Figure 2 displays two vertical bars for each state, one representing the portion of the labor force that is informal and the other representing the portion of the labor force that is formal. As mentioned in the summary statistics, there are more informal workers than formal workers and the difference diminishes over the survey periods. Interestingly, not all states see an increase in the relative size of the formal sector. The regions Baja California Sur, Coahuila, Durango, Jalisco, Nuevo Leon, Oaxaca, Sonora, y Yucatan see significant increases in proportion of formal workers, while other states see smaller increases and Morelos and Guanajuato see small decreases in proportion of formal workers. The indicator variable method is advantageous because each state variable captures the difference between portion of workers that are formal and informal for the state in question. Under a continuous specification, the effects are grouped into one variable and many observable differences are left in the error term. An example of improved outcome caused by state control dummies is the increase in coefficient value on *High School* from .216 to .276 in MxFLS-2. In *Model A,* endogeneity occurs in *High School* because there is correlation between

Figure 2


Workforce Composition by State
2002
2005
2009
Percent of Worforce
0 10 20 30 40 50 60 70 80 90 100
B Cali Sur
Coahuila
DF
Durango
Guanajuato
Jalisco
Estado de Mexico
Michoacan
Morelos
Nuevo Leon
Oaxaca
Puebla
Sinaloa
Sonora
Veracruz
Yucatan
Formal Laborers
Informal Laborers

High School and state trends in the error term. A plausible explanation is that formal job opportunities are less common in certain states and, by controlling for state with a continuous variable, the model fails to capture the negative effect of living in one of these "low opportunity" states. This negative effect is unobserved and incorporated into the error term. If the "low opportunity" states have a sizable portion of high school graduates working in the informal sector, the coefficient value on *High School* decreases. Once the individual state variables are added, the negative effect of living in a "low opportunity" state is captured in the indicator variables and the coefficient on *High School* increases as it is no longer confounded with individual state effects in the error term.

Model C

In *Model C,* displayed with marginal effects in Table 6, an interaction term is created from variables *married* and *female* and the sector control variable is changed from a continuous variable to a set of three indicator variables representing white collar, blue collar, and service jobs. The summary statistics section showed no difference in informality rate means between men and women and showed married individuals to have lower mean informality than unmarried individuals. Since most marriages are between men and women, including a variable that interacts *married* and *female* allows for analysis of gender differences within unmarried individuals and within married individuals. In MxFLS-1 and MxFLS-2, the coefficient value for *female is* small and insignificant, suggesting that there no gender differences in job formality between single men and women. MxFLS-3 shows a different and particularly interesting result. The coefficient on *female* is negative and significant in *Model B*, but is positive and significant in *Model C*. Therefore, in MxFLS-3, women generally have higher propensities to join the informal

Table 6: Model C

	Base MxFLS-1	Marginal Effects	Base MxFLS-2	Marginal Effects	Base MxFLS-3	Marginal Effects
female	0.088*	0.032	-0.021	-0.002	0.121**	0.043
	(0.052)	(0.018)	(0.054)	(0.019)	(0.049)	(0.018)
age	0.054***	0.019	0.048***	0.015	0.095***	0.031
	(0.008)	(0.003)	(0.008)	(0.003)	(0.009)	(0.003)
agesq	-0.001***	-0.000	-0.000***	-0.000	-0.001***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
jefe	0.053	-0.012	0.059	0.013	0.010	0.002
	(0.055)	(0.019)	(0.052)	(0.019)	(0.043)	(0.016)
married	0.190***	0.060	0.148***	0.052	0.161***	0.058
	(0.056)	(0.019)	(0.054)	(0.019)	(0.049)	(0.018)
urban	0.098**	0.031	0.214***	0.062	0.260***	0.090
	(0.043)	(0.014)	(0.043)	(0.015)	(0.039)	(0.014)
marfem	-0.228***	-0.087	-0.126	-0.047	-0.227***	-0.069
	(0.085)	(0.057)	(0.084)	(0.030)	(0.075)	(0.027)
education						
Less than	-0.446***	-0.131	-0.454***	-0.141	-0.518***	-0.159
	(0.064)	(0.019)	(0.064)	(0.020)	(0.063)	(0.020)
Elementary	-0.188***	-0.057	-0.242***	-0.082	-0.370***	-0.119
	(0.050)	(0.017)	(0.050)	(0.017)	(0.048)	(0.016)
High School	0.176***	0.065	0.224***	0.074	0.389***	0.126
	(0.059)	(0.022)	(0.057)	(0.022)	(0.051)	(0.021)
College	0.105*	0.029	0.172***	0.030	0.546***	0.153
	(0.057)	(0.022)	(0.058)	(0.024)	(0.054)	(0.023)
job type						
Wht Collar	0.024	0.008	0.278***	0.082	-0.179***	-0.076
	(0.047)	(0.016)	(0.047)	(0.017)	(0.045)	(0.016)
Service	-0.256***	-0.078	-0.096*	-0.027	-0.406***	-0.150
	(0.054)	(0.017)	(0.057)	(0.019)	(0.054)	0.019
Observations	5400	5400	4989	4989	5206	5206

Standard errors in parentheses

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

sector than men, but single women are more likely to be formal than single men. In the subset of married individuals, men receive a "1" value for *married* and a "0" value for *female* and *femxmar* and women receive a "1" value for *married, female,* and *femxmar.* For both MxFLS-1 and MxFLS-3, *Model C* shows strong evidence that married women are more likely to join the informal sector than married men and for MxFLS-2 evidence of this difference is present but weaker. In MxFLS-1 and MxFLS-3, *married* has a positive and significant coefficient. This suggests married men are less likely to work in the informal sector than unmarried men and women. On the other hand, the coefficient on *femxvar* negative and significant implying that married women are more likely to work in the informal sector than married men. Since the coefficient value on femxvar is also larger in magnitude than the coefficient on *married,* the *Model C* also provides evidence that married women are more likely to join the informal sector than single men and women. Model C for MxFLS-2 provides weaker evidence that formality difference between married men and married women exist because the coefficient on *femxvar* is negative but is not significant at the 90% level or higher. Because standard error on *femxvar* is relatively small and the coefficient is significant at the 85% level, this evidence is considered weak instead of insignificant.

Lastly, the sector variable is changed to a series of three indicator variables that place individuals into one of the three job categories: Blue Collar, White Collar, and Service. The motivation behind this change is similar to the motivation behind the change in state variable; using indicator variable groups allows for more specific identification of between-sector differences. Additionally, the coefficients and standard errors for the sector indicator variables have relevant interpretations. Before interpreting results, it is important to recall that MxFLS-3

includes a much larger proportion of white collar workers than the MxFLS-1 and MxFLS-2. This data methodology difference makes analysis between the three surveys more difficult. The base variable for job sector is *Blue Collar* because, in MxFLS-1 and MxFLS-2, *Blue Collar* contains the highest proportion of workers. In MxFLS-1, individuals that work in the service sector are more likely to participate in the informal sector than individuals working in the white collar or blue collar sectors. There is no significant difference in formality propensity between white collar and blue collar workers. In MxFLS-2, white collar workers are significantly more likely to operate in the formal sector than blue collar and service workers and there is no significant different in formality propensity between blue collar and service workers. In both survey editions, white collar workers have lower propensities to be informal than service workers, while the propensity for blue collar workers to be formal has different relative effects depending on survey edition. In MxFLS-3, both service workers and white collar workers are more likely to participate in the informal sector. The results show that service workers operate in the informal second twice as much as white collar workers. The extremity in these results can be attributes to data specification differences between the survey years. The overall conclusion from the results section is that younger, unmarried men and married women with lower levels of education living in small rural towns and working in the service sector have the highest propensity to work informally. Additionally, older women and men, high school graduates, and urban residents are more likely to be in the formal sector.

Additional Specifications

The outcomes from the results sections add explanatory power to the original Khamis (2009) probit model. Using the final model as a foundation, this section will present three extensions to

further explore informality in the Mexican labor market. First, I will analyze the influence of violent assault experiences and participation in cash transfer programs on informality using additional variables and an instrumental variable identification. Second, the role of income will be analyzed by running the final model using data that is stratified by income level. Finally, I will introduce variables accounting for firm size to the final model.

Income

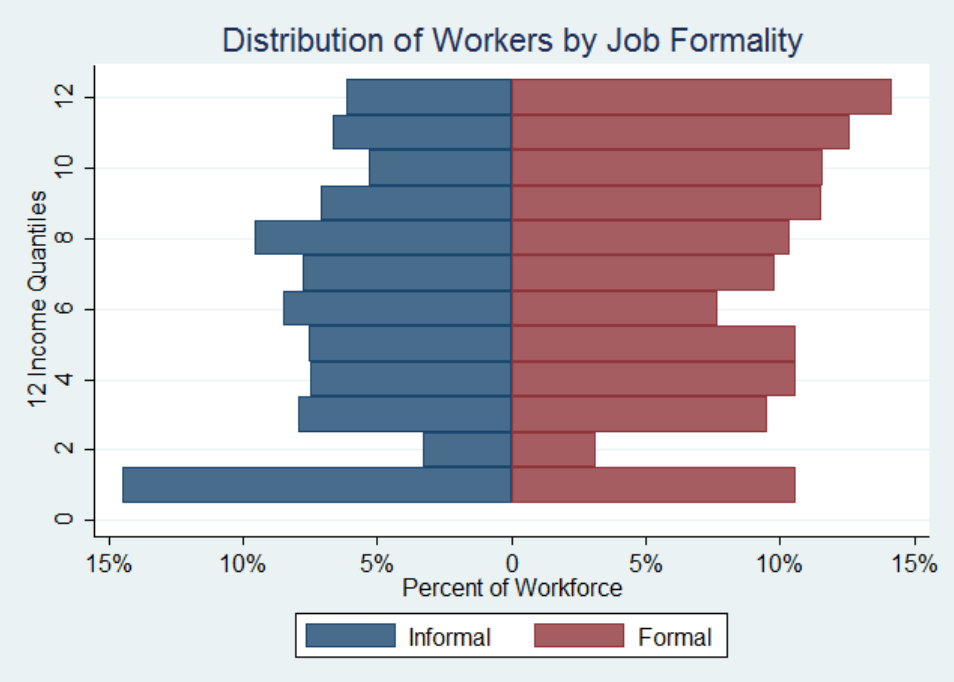
Heterogenous wage segmentation is a elementary feature of informality in developing economies. This means that the informal labor market does not have a uniformly lower wage than the formal labor market. Graph 3 shows the differences in wage distribution of wages between the formal and informal sector. It is important to note that, although wages in the formal and informal sector overlap, formal wages skew significantly higher than informal wages. 15% of informal workers that earn no wage or far below minimum wage, while almost 15% of formal workers are at the highest income quantile.

Table 7 displays the final model over lower, middle, and upper income level quantiles for MxFLS-1, MxFLS-2, and MxFLS-3. Correlations between characteristics and propensity to join the formal sector display consistencies and inconsistencies at different income levels and survey editions. Across the three survey editions, coefficients on *age* tend to decrease in value and significance as income level increases, coefficients on lower educational attainment are negative and significant at almost all income levels, and coefficient values on household head are insignificant at all income levels. Older age is more likely to raise propensity to be formal among lower income people than it is among higher income people. Younger workers have less time to build capital in the labor force and are less likely to find formal work. Young workers that enter

the workforce at higher levels of income have high education attainment to substitute lack of experience. This effect could equate formality status among wealthier individuals at different ages. Workers with less than elementary education see large and significant trends to informality. Completing elementary school makes workers more likely to join the formal sector than completing less than elementary, although the magnitude of the effect depends on the survey edition. Lower income people with elementary education in MxFLS-3 are only slightly less correlated with the informal sector than low income people with less than elementary education, while the opposite is true in MxFLS-1. Lastly, coefficients for the household head variable are insignificant across income level and survey edition.

The inconsistencies reveal characteristics that differentiate formality trends among lower, middle, and upper income workers. Unmarried women have significantly higher propensities to be formal than unmarried men in the middle and upper echelons of the income distribution, but

Figure 3



there is little differentiation at the lower end of the income distribution. Young women earning low wages in the informal sector tend to work in domestic service, which might equate their average formality status to that of men at the lower income levels. At the middle and upper levels of income, this effect is muted because domestic jobs cease to exist. Relationship status varies widely in its effect across income and relationship status. For example, married women are more likely to be in the informal sector than unmarried women and married men at the middle-income level in MxFLS-1 and the lower income level in MxFLS-2, while they have lower propensities that unmarried women in the upper income levels in MxFLS-1 and MxFLS-3. The conclusion from relationship status is ambiguous. Data inconsistencies for the job type variables in MxFLS-3 inhibit comparisons and income level inconsistencies between MxFLS-1 and MxFLS-2 are ambiguous as well.

Firm Size

Table 8 displays the final model segmented by firm size for MxFLS-1, MxFLS-2, and MxFLS-3. We account for firm size by segmentation rather than inclusion of a firm size variable because strong endogeneities exist between firm size and our definition of formality. Firm size is a feature of informality under the productivity definition and Khamis (2009) shows that there are strong correlations between legalistic and productivity definitions. In other words, larger firms are likely to offer social security, while small firms are more likely to employ workers without offering social security. Including a firm size variable in this model would cause a reverse causality between firm size and formality, inflating coefficient values and standard errors.

Workers in firms of 51 employees or more show few significant variables in the three survey editions, suggesting that workers in large firms tend to be employed formally. The relatively

lower amount of differentiability can be attributed to the large proportion of formal workers or to worker indifference between formal and informal work when joining large firms. The models indicate that large firm workers tend to be older, married men that have higher levels of education and work in non-service jobs.

Coefficient values on education attainment variables lower than middle school are negative for most model iterations. Magnitude and significance diminish as firm size increases, which implies graduating from elementary and middle school increase likelihood of finding formal work, particularly when searching for jobs in smaller firms. Education attainment above middle school has similar, but weaker, implications. Completing high school has positive effects across all three surveys with small standard errors, but completion of college only has consistently positive effect for workers in small firms. Low coefficient values and high standard errors suggest workers in large firms with a college education have no discernable correlation to formal or informal employment. This could represent a difference between high and low paid workers at larger firms. Firms have cost reduction incentives to avoid social security provision. Unskilled, low-wage workers in large firms are vulnerable to experiencing this regulation violation because alternative jobs in the informal sector leave them with low opportunity costs and little bargaining power. The lack of correlation between college education and formality may also be a result of characteristic uniformity within large firms.

Small firms are the focal point of informality in Mexican labor markets. Summary statistics revealed that firms with less than 5 employees is the only firm size category populated by a significantly larger proportion of informal workers. Final model for workers in firms with 5 or less employees return stronger coefficient effects than models for workers in larger firms, because

worker characteristics are most likely to differentiate informal and formal workers in small firms. The differentiating variables are similar to those in large firms (formal small firm workers tend to be older, married men that have higher levels of education), but the magnitude and statistical significance of the effects are higher. Married men, college educated workers, high school educated workers, and white collar workers have high coefficient values compared across the different firm sizes and survey series. This is particularly strong evidence that these characteristics are associated with informality because firm size is an alternative informality measurement method.

Violence

Mexico has experienced a surge of violence in the 2000's, mainly stemming from powerful drug cartels. This trend prompts an exploration of a previously uninvestigated topic: the relationship between individual experience of violence and labor market decisions. BenYishay and Pearlman show that violence reduces total hours worked, but no study relates experience of violence to informality. Using Mx-FLS and INEGI data, this relationship is addressed in two parts. First, Table 9 shows the results from running 4 versions of Model C, each containing a different variable representing violence. Second, the endogeneity in the *assault* variable is addressed using an instrumental variable identification. This analysis is done using only MxFLS-1 because violent assault data in MxFLS-2 and MxFLS-3 is unreliable.

Table 9 presents only the coefficient estimates and standard errors for the violence related variables added for this section of the study. Model 1 in Table 9 shows results from including *assault* to Model C. The *Assault* variable, constructed from the MxFLS-1 survey, takes the value of 1 if an individual has ever experienced violent assault and a value of 0 if the individual has not.

The positive and significant result suggests that individuals who have experienced a violent assault have a lower propensity to join the informal sector than individuals who have never experienced a violent assault. To see if the robustness of the relationship between violence and formality status holds, *assault municip* is included in Model 2. The variable *assault municip* is a ratio that represents experiences of assault at the municipality an individual inhabits. Using data from MxFLS-1, total number of individuals that have experienced violent assault in a municipality is divided by number individuals in that municipality. This variable tests whether the violence occurring in a municipality has an effect on the general labor market in the municipality. The coefficient value for the *assault municip* variable is positive but insignificant, which suggests there is no spillover effects of violence at the municipal level. This does not support the results in Model 1 and provides evidence that the positive relationship between individuals who have been assaulted and informality may be correlated with formality through the error term. For two additional robustness tests, models 3 and 4 utilize variables that are constructed using homicide data from INEGI at the state and municipal levels. The variable *homicide rate state* in Model 3 assigns state-level per-capita homicide rate to individuals for their respective state. This result is negative and insignificant, once again contradicting the significant result in Model 1. *Homicide rate municip* in Model 4 assigns the municipal-level per capita homicide rate to individuals living in the respective municipality. Once again, this result is negative and insignificant, suggesting further that violence rate does not have an impact on formality status.

Although Models 2 – 4 in Table 9 contradict significance of violence, Model 1 still suggests that individuals that have experienced a violent assault may have a relationship with the formal sector. I hypothesize that the significance of the *assault* variable occurs because it is endogenous.

To instrument for endogeneity, I use the state homicide rate variable from Model 3 in Table 9. The instrumental variable receives a value of 1 if the corresponding individual lives in a state with a homicide rate higher than 1 per 10,000 people and 0 if lower than 1 per 10,000 people.

In the case where endogeneity is present, there is an unobserved effect that drives the positive correlation. For example, workers may be simultaneously more susceptible to violence and more likely to be in the formal sector because they are wealthier. Another example of unobserved variation effecting formality and exposure to assault is age. Older workers are more likely to acquire a formal job and live longer, raising the probability that they will experience some form of violent assault.

An IV can adjust for endogeneity if correctly identified. Correct identification occurs when the IV meets the relevance and exclusivity requirements. An instrument is relevant if it is correlated

Table 9: Violence

	1	2	3	4
assault	0.148***			
	(0.047)			
assault municip.		0.298		
		(0.259)		
homicide rate state			-0.098	
			(0.246)	
homicide rate municip.				-6.169
				(3.903)
Observations	5797	5750	5797	5750

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

with the endogenous variable it is instrumenting and an IV is exclusive if it affects the dependent variable only through the endogenous variable it is instrumenting. The Exclusion category in Table 9 shows that there is no significant correlation between state homicide rate and job formality status and the First Stage category shows that state homicide rates are highly correlated with individual experience of assault.

Second stage is the result from the instrumental variable regression. The estimate on violence in the second stage represents the effect that experiencing a violent assault has on formality status through the non-endogenous part of *violence*. The non-endogenous part of violence is identified by homicide rate, which meets the two requirements for an instrumental variable. The

Table 10: Instrumental Variable Regressions

	IV 1
First Stage	
homicide rate	0.349***
	(0.039)
Dependent:	violence
Second Stage	
violence	-1.198
	(2.475)
Dependent:	formal
Instrumented:	violence
Instruments:	hom. rate
Wald	0.210
Observations	5140

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

results from IV 1 shows that violence has a negligible effect of formality status. Although the coefficient value is negative and large in magnitude, the standard error is high deeming the result insignificant.

Conclusion

The informal sector is an essential and functional feature of LDC labor markets worldwide. Informality is a dynamic concept and effective empirical research must adapt itself according to the context of national labor markets to uncover the specificities of informality in the country of study. This paper contributes to informality research by uncovering the relationship between worker characteristics and propensity to join the informal sector in Mexico. The following three research questions were addressed:

1. How does educational attainment, relationship status, geographical location, and job type determine propensity to join the informal sector for men and women in Mexico?
2. Does the relationship between these worker characteristics and informality vary across income levels and across firm size?
3. Is there a relationship between violent assault and participation in the informal market?

I find that younger, unmarried men and married women with lower levels of education living in small rural towns and working in the service sector have the highest propensity to work informally in Mexico. I also find that married women are more likely to work in the informal sector than married men and that individuals who completed high school have higher propensities to join the formal sector than individuals that complete college. In the income and firm size sections, I find formality differences between women and men exist in lower income groups and smaller

firms, but not upper income groups and larger firms. Additionally, high school and college education reduces likelihood of joining the informal sector for upper income groups, but not lower income groups. Older, married men that are not in non-service sector jobs tend to work in formal positions at large firms and small firms. Finally, analysis of violence suggests that violent assault experience has a negligible effect on formality status.

My findings support the findings in Khamis (2009) and Gasparini and Tornaroli (2009) and contribute new information about the informal sector in Mexico. Findings that higher levels of education, older age, and marriage reduce propensity to join the informal and that informal individuals are concentrated in low income groups and small firms supports previous literature. On the other hand, findings on married women, individuals in high income groups and large firms, and violence add new information to the Mexican informality literature. Further studies must address the relationship between public policy and informality, which continues to be an understudied feature of the Mexican informal sector.

CHAPTER 2

Introduction

Labor market legislation literature provides substantive evidence suggesting Latin American countries tend to favor restrictive labor policies that support the well-being of formally employed workers (Edwards et al 2001; Murillo 2001). Favoring these kinds of policies typically comes at a cost; restrictiveness is associated with labor market inefficiencies such as increased unemployment and growth of the informal sector (Heckman and Pages 2000; Freeman 2000; Basu et al 1996). Consequently, labor legislation is central to the Latin American policy narrative. The labor discourse within each country includes proponents for increased regulation and a competing faction in favor of less regulation. This ideological dichotomy is evident in various Latin American countries, particularly in the case of Argentina where politically left Peronist regimes tend to intensify enforcement and politically right regimes that favor free trade policies and invite foreign direct investment are more likely to 'turn a blind eye' to enforcement (Ronconi 2010; Murillo 2011). The labor policy debate focuses on enforcement intensity and restrictiveness of prevailing laws, but policy makers pay less attention to the government's ability to enforce labor laws effectively. Addressing this gap of knowledge is important because variability in violation rates across population segmentations changes the context for policy decisions. Recent studies in MERCOSUR countries have leveraged detailed individual level population surveys to measure labor law violation rates, which capture workers who experience violation and workers in the informal sector (Kanbur and Ronconi 2013; Ronconi 2010; Almeida 2007). The goal of this paper is to, first, use an individual level survey data to identify labor law violation rates for the case of

Uruguay, second, to extend the study using a variant of the Alkire-Foster multidimensional poverty measurement model and, third, to suggest a research agenda concerning enforcement resources and informality based on the finding

Motivation

In addition to policy relevance, the centrality of labor rights to Uruguay's political narrative and the opportunity for comparison between MERCOSUR countries motivates this analysis of labor violation rates. Labor rights legislation is a particularly contentious policy debate in Uruguay that is rooted in the rich history of Uruguayan *sindicatos*, unions supported by the political left that leverage a considerable amount of political power. Socioeconomic outcomes of the unionist policy agenda, which positioned Uruguay as a pioneer in socioeconomic labor reform, sharply contrast the corruption that plagued union leadership and the civil disorder caused by strikes and protests. As a reaction to economic recession in the 1970's, the military dictatorship stoked the heated policy debate by outlawing collective bargaining and sequestering union leaders. Democracy saw collective bargaining laws return to the political arena with powerful political and emotional baggage that transcend ideology and cause the Uruguayan labor law debate to be particularly contentious (Alexander 2005). Internationally, there is potential to gain insight from comparison of compliance rates between in Uruguay and the economically similar MERCOSUR countries of Argentina, Brazil, and Chile, where empirical studies have addressed labor law violation.

Literature Review

Literature examining outcomes of labor restrictions is deep and inconclusive. The goal of this literature review is to accentuate labor market regulation implications for developing countries and to review empirical studies on violation and compliance in Latin America.

Labor regulation across countries varies due to the heterogeneous nature of labor markets. Unique elements of a labor markets change the policy strategy in different countries and in different sectors within that country. Salient features of labor markets in developing countries include: low earnings levels, long work hours, uncertainty, and gender inequality. In the words of Gary Fields, "developing countries have an employment problem – that is, poverty among those who work – rather than an unemployment problem" (Fields 2004). Therefore, regulation in developing countries often has different implications than regulation in developed countries. For example, the effect of regulation on poverty and income distribution is shown to be particularly steep in Latin America (Khamis 2013; Lustig 1996). Specifically, Maloney and Mendez argue that "the tradeoff between any possible effect on poverty and reduced flexibility is likely to be more severe in Latin America" (Maloney and Mendex 2004). In a study comparing minimum wage policy in the United States and Puerto Rico, Freeman concludes that when a minimum wage policy with little employment implications in the United States is implemented in Puerto Rico, unemployment increases severely (Freeman and Freeman 1991). This highlights the importance of developing a deep understanding of the implications labor regulation policy has in Latin America.

Considering the relevance of labor law enforcement to the context of Latin American development, large gaps in the Uruguayan labor regulation literature exist. There is no formal

description of true violation rates and there is no analysis connecting enforcement resources with labor market compliance or informality with labor regulations. This kind of research is undertaken in a variety of developing countries, many in the MERCOSUR region (Kanbur and Ronconi 2013; Bhorat et al 2012; Ronconi 2012; Ronconi 2010; Almeida and Roncoi). For brevity and relevance, this literature review will focus on MERCOSUR countries. In Chile, one third of workers are excluded from at least one of four legally mandated benefits and higher levels of non-compliance is experienced among women, indigenous peoples, less educated workers and workers in smaller firms. Probit models suggest that race, age, years of schooling, and gender are significant determinants of non-compliance. Studies in Brazil and Argentina address the relationship between enforcement intensity, informality, and economic outcomes. In the case of Brazil, Almeida finds that a standard deviation increase in the log of inspections per firm leads to a 15 percentage point reduction in the proportion of informal workers in the city, a 9 percentage point increase in the unemployment rate, and a 5 percentage point reduction in the poverty rate. For the case of Argentina, Ronconi attempt to model the relationship between likelihood of violation, measured using a multidimensional approach, and enforcement intensity. Presence of democratically elected politicians is used to instrument enforcement intensity, addressing the endogeneity that exists between enforcement and compliance. Ronconi finds that regions with more labor inspectors and democratically elected presidents tend to see a reduction in firm noncompliance.

Data and Methodology

Data

Data for this paper is from the Encuesta Continua de Hogares (ECH), an annual survey conducted by the Instituto Nacional de Estadistica in Montevideo, Uruguay. ECH is a household and individual level survey that contains demographic and labor market characteristics. The survey contains 46,937 household observations and 132,600 individual observations. For the purposes of this study, I will focus on adults with a primary source of income that are not self-employed, are not employed in domestic work, or are not employers. The sample size for this subset of laborers in the 2014 survey is 38,129 observations. Additional details provided upon request. The longitudinal analysis uses data from 2002 through 2014 and the cross-sectional analysis uses data from 2014. The intention of the yearly analysis is to capture changes in labor law violations before and after the Argentine credit crisis of 2001 and the 2008 recession. The descriptive analysis will offer perspective on the current state of compliance in Uruguay.

Minimum Wage Legislation

Historically, the Uruguayan government has placed a high level of importance on labor laws and labor regulation. In 1943, the Uruguayan government, under President Juan Jose de Amezaga, conducted a study of Uruguayan low and middle class worker living conditions, an unprecedented effort in Latin America. The study was followed by the creation of "el consejo de salaries," a piece of legislation emphasizing the role of the minimum wage as a level of income that "allows the worker to satisfy his or her physical, intellectual, and moral obligations." World Bank and government data shows that Uruguayan minimum wage increases are among the

steepest in Latin America. A new minimum wage is mandated every year and sometimes more than once every year. The chart below shows minimum wage changes every January in the years of focus for this study at nominal rates and real values using 2010 Uruguayan pesos as a baseline. Minimum wage changes within years are not listed.

Year of min wage change (January)	Nominal Min Wage	Real Min Wage (2010)
2002	1040.00	2011.22
2005	2500.00	3544.10
2007	3244.00	3997.54
2008	4150.00	4741.23
2009	4441.00	4743.57
2010	4799.00	4799
2011	6000.00	5550.93
2012	7200.00	6161.75
2013	7920.00	6242.61
2014	8960.00	6486.64

Additional legislation

In addition to minimum wage standards, the Uruguayan government provides workers with the right to paid vacation, overtime pay, social security, and bi-yearly Aguinaldo bonuses. The strictness of these regulations are, in large part, a result of the powerful *sindicatos*. The initial empirical analysis for this paper focuses on compliance of three labor laws in addition to minimum wage: hourly workweek, Aguinaldo payment, and social security provision. Uruguayan workers are limited to working 8 hours per week and either 44 or 48 hours per month, depending on the industry the worker participates in. The second labor law we measure is the Aguinaldo.

This is a required bonus worth one monthly salary (pay in Uruguay is measured by month) paid every December and June, so the Uruguayan worker effectively gets 13 months of pay throughout the year. Lastly, the Uruguayan government requires firms to enroll workers in the social security contribution programs. Two additional pieces of legislation, vacation pay and overtime pay, are included to complete the Alkire – Foster extension. The extensions section describes these additions in detail.

Methodology

Minimum wage violation measurement will follow the methodology developed by Bhorat et al. for analysis of the South African labor market:[2]

$$V_a = E\left\{\left[\left(w^m - w\right)/w^m\right]^\alpha\right\}$$

The V_a variable measures different aspects of minimum wage violation that depend on the value of alpha (0, 1, or 2). V_0 is a binary variable that describes whether an individual is earning less than the minimum wage. The V_0 value is a headcount ratio of workers in the identified subdivision that earn less than the minimum wage. V_1 and V_2 measure shortfall depth, where V_2 emphasizes larger gaps. The ratio V_0/ V_1 is the average percentage shortfall of workers earning below the minimum wage in a particular subdivision.

Calculating measurements for other labor law violations is much more straightforward. For hourly workweek, Aguinaldo payment, and social security coverage a dummy variable is assigned a value of 1 for workers that are violated and 0 for workers that are not violated. Total

[2] See Bhorat et al (2011) for full methodology

workers facing a violation divided by total eligible workers in the specific labor market segmentation results in a headcount ratio, which is the value presented in the results tables.

Results

Kernel density plots

Kernel density plots presented in the appendix, based on the natural logarithm of hourly wage, demonstrate distributions in wages for different sectoral determinations available in the ECH. The red vertical line indicates the natural logarithm of the 2014 hourly minimum wage. Sections of the density function that lie to the left of the red line represent laborers who receive an hourly wage lower than the minimum hourly wage. A simple visual analysis suggests that workers who participate in the public sector, are highly educated, work in larger firms, and live in urban areas are less likely to earn below the hourly minimum wage than workers who have low levels of education and workers who are employed by small firms. In addition to revealing characteristics of minimum wage earners, kernel densities provide insight by revealing peculiar patterns at the minimum wage line. A prominent branch of wage theory asserts that a spike in wages occurs at the minimum wage line because of a firm's decision to either comply and pay workers the legal minimum wage or not comply and pay below minimum wage (Ashenfelter and Smith 1979). For the case of Uruguay, kernel density plots with substantial amounts of workers earning less than the minimum wage do not show spikes at the minimum wage line. In fact, the slope of wage distribution illustrated by these kernel density plots tends to increase and decrease smoothly. This outcome suggests different theoretical underpinnings. It could be the case that instead of making the decision whether to comply with minimum wage, firms that have decided

to pay below the minimum wage must choose the level of severity at which to violate the law. This decision depends on risk of receiving a fine, a function of enforcement effectiveness, and punishment rates. Because the Uruguayan government does not provide this information (Marinakis 2014), further research into relationship between spikes at the minimum wage distribution and enforcement effectiveness is required.

Violation Estimates

This section discusses violation rate measurement results for various segmentations of Uruguayan workers. Four dimensions of labor laws are presented: minimum wage, hours worked, yearly bonus, and enrollment in social security programs. Each table also presents the ratio of workers facing one or more violation. The results cover violation rates for the various segmentations in extensive detail, so I will only be discussing particularly notable results.

Figure 4 shows share of workers the experience one or more labor violation over time. The decreasing trend line shows labor law compliance in Uruguay improved between 2002 and 2014. Table 11 presents average occurrence of labor law violation for all Uruguayan workers in years 2002 - 2014. Before continuing the analysis, it is important to note that, for years 2002 – 2013, I am unable to correctly identify the hours worked violation dimension because the ECH does not ask workers if they receive overtime pay. The hourly violation measurements marked with * count any worker that worked more than 48 hours in one week and are not particularly insightful. The measurements of one or more violation marked with * only take minimum wage, Aguinaldo, and social security into account, although these headcount ratios continue to be insightful for the analysis. V_0 values tend to remain relatively constant around 6% of all workers, although average shortfall percentage continuously increases over time. This indicates that,

while the headcount of workers violated in the minimum wage dimension remains constant, wages for violated workers are decreasing over time. In 2011, 2013, and 2014 workers earning less than the minimum wage experienced, on average, over a 50% shortfall rate. The ratio of workers violated in Aguinaldo bonus and social security dimensions decreased sharply between 2002 and 2014. These decreases contributed to the fall in workers experiencing one or more violation. This trend is particularly interesting, as it is probable a causal relationship between the decrease in these violation rates and an outside shock to the Uruguayan labor market exists.

Tables 12, 3, and 14 present labor law violation rates for various worker segmentations in 2014. In order to provide a point of comparison, notice that, in 2014, 6.2% of Uruguayan workers earn below the minimum wage, average wage shortfall was 51.2%, 7.1% of workers did not receive Aguinaldo bonus, 8.4% of workers did not receive social security, and 17.5% experienced violation in at least one of these dimensions. Table 12 analyses workers by segmenting into age, gender, education, residence upon birth, and ethnicity. Early career workers and retirement age workers experience the most frequent incidences of one or more violation with rates of 23.7% and 37.8% respectively. Females are more likely to be violated in at least one dimension than males, although the difference is only 2.4%. When workers separated by education level we see that higher education levels result in a lower probability of facing at least one violation. The downward trend seen in Figure 5 highlights the strength of this relationship. Differences in place of residence upon birth do not cause strong variation in probability of experiencing one or more violation. Finally, segmentation by ethnicity shows that black Uruguayans are most likely to experience at least one violation. Particularly striking is the 11.3% rate of minimum wage violation for black Uruguayans.

Table 13 segments workers into employment type (private employers, public employers, cooperative employment, and social program employment) and firm size. The rate of one or more violation for privately employed workers was 18.1%, 16.9% higher than publicly employed workers. This suggests that the government closely follows its own minimum wage laws, but may experience difficulties enforcing in the private sector. Workers participating in cooperative and social program employment are much more likely to experience at least one violation than private or public sector workers. These results are unsurprising as both of these employment options are short term safeguards against frictional or structural unemployment. Firm size has large variation in violation rates. In single-person firms, 21.4% of workers earn below the minimum wage and 50% of workers are violated in at least one dimension. As firm size increases, fraction of workers facing at least one violation decreases sharply. Workers at firms with more than 9 employees are less likely to experience a labor law violation than the average Uruguayan worker.

Table 14 presents labor violation measures for workers segmented into the 19 state departments of Uruguay and into urban or rural residence. Montevideo, the only urban department, has a relatively low rate of at least one violation, 10%. Comparing violation rates across departments, we notice that many departments with high violation rates, such as Artigas, Cerro Largo, Salto, and Rivera lie on the border with Brazil or Argentina. The strong difference in violation rates between Montevideo and the border regions may result from the fact that Montevideo is the administrative locus of the Uruguayan government, and border regions are farthest from the captal. Finally, workers are seperated into an urban category, 2 small town categories, and a rural category. Rural workers have the highest likelihood of experiencing at

least one violation, with a rate of 22%. Workers in Montevideo earn below the minimum wage at a relatively low rate, but there is little variation in fraction of workers earning below minimum wage between urban and rural areas.

Lastly, a probit analysis is conducted to check the validity of relationships identified in the data description exercise. Experiencing one or more violation is the dependent variable for all three models. Model 1 includes independent variables representing three worker segmentations where violation rates varied significantly: age, education, and gender. The education variable is transformed into a continuous measure of total years of school for ease of interpretation. Since all variables are highly significant, the model provides further evidence that older, well educated, male workers are less likely to experience at least one labor law violation. In the second model, variables representing black workers and workers living in cities with more than 5,000 people also appear to be highly significant. This suggests that non-black, urban workers are also less likely to experience at least one labor violation in Uruguay. Lastly, model 3 includes dummy variables for the 19 regions and for firm size. The important change to notice after the addition of these dummies is the change *bigtown* from negative to positive and from significant to insignificant. Accounting for the worker's region may be endogenous with the *bigtown* variable, reducing explanatory power.

Three major takeaways from the results of this analysis are 1) labor law violation has progressively decreased since 2002 2) black, female, and young laborers who have low education, live in rural areas, and work in small firms are most likely to face at least one labor violation and 3) rural regions and regions near the border of Uruguay have higher violation rates than Montevideo.

Research Extensions

After developing an understanding of labor law violation rates in the Uruguayan labor market, additional research questions can be addressed. In this section, I will extend my analysis of Uruguayan labor law violation by applying the Alkire – Foster method to labor violation dimensions and discuss additional possible research extensions.

Alkire-Foster Method

Alkire and Foster (2011) propose a model that measures poverty from a multi-dimensional perspective. The intuition behind the model is as follows. First, an appropriate headcount measurement identifies whether an individual is in poverty. For each dimension of poverty, individual p_i receives a value of 0 if the individual is not considered deprived and a value of 1 if the individual is considered deprived. A summation of the dummy variables across all dimensions for each individual produces a poverty score for individual i. In order to derive a headcount measurement the researcher must select a cutoff point, or the total count of deprived dimensions that qualifies an individual as poor from a multi-dimensional perspective. Alkire and Foster assign variable H to identify the poverty headcount ratio. In addition to the headcount ratio, deprivation share across the poor is factored into the analysis. Denoted as A, average deprivation share is included because the headcount ratio fails to capture changes in the dimensional deprivation count among individuals that already are considered poor. For example, if an individual is considered deprived in three dimensions, the value of H will not change when that individual becomes deprived in six dimensions. Measurement A is the total incidences of deprivation divided by the product of total dimensions and total individuals in poverty. The

product of H and A results in a simple measurement, M, that is sensitive to the frequency and breadth of poverty:

$$M = HA = \frac{q}{n} * \frac{c(k)}{qd}$$

Adaptation of Alkire-Foster

While this paper does not address poverty directly, the availability of multiple labor compliance measurements allows for implementation of the Alkire-Foster method to identify an alternative measurement for workers that do not meet compliance standards. In order to mimic the Alkire Foster method for labor market compliance, additional compliance dimensions must be identified and the methodology used by Alkire and Foster must be reinterpreted for the case of a labor market.

In the 2014 ECH, questions addressing the availability of paid holiday and paid overtime hours allow for the construction of two additional dimensions of labor compliance. In Uruguay, workers are entitled to holiday pay equal to 100% of salaried pay. The ECH question asking adults in the labor market if they are offered paid vacation time is used to construct a dummy variable for the fifth compliance dimension in this study. Workers that report access to holiday pay receive an assignment of one and workers that report no access to holiday pay receive an assignment of zero. The second ECH question addresses overtime pay by asking workers whether they receive lawful compensation for working overtime. The Uruguayan government requires firms to pay double salary to employees that work over 44 or 48 hours per week, depending on industry. This question is already integrated into the calculation of the workhours dimension, as employees that work overtime and receive the legal overtime pay are counted as compliant with work hours

legislation. Nonetheless, lawful overtime compensation is an insightful sixth dimension of labor compliance because workers that choose to avoid overtime work because they do not receive fair pay are observed by the question.

An adjustment of the M measurement fits the context of labor violations intuitively, allowing for insightful replication of the Alkire and Foster method. Total population, n, will remain unchanged and total deprived individuals, q, will become total individuals with two or more compliance violations, q_v. For the purposes of this study, individuals included in q_v are non-compliant workers and the headcount measurement H_v represents the percentage of individuals in the labor market that are non-compliant. Variable $c_i(k)$, the fraction of dimensions an individual is deprived in, will become $c_i(v)$, fraction of labor laws an individual violates. Measurement A_v is the average violation share across non-compliant individuals. Under this redefinition, we have the following expression for M (where d_v is violation dimensions):

$$M_v = H_v A_v = \frac{q_v}{n} * \frac{c(v)}{q_v d_v}$$

A second measurement, M_0^b, is also included. This measurement simply changes the weight of the minimum wage dimension to 50% and assigns the remaining dimensions a weight of 10%. This adjustment follows the methodology of the Mexican government, who use multidimensional poverty measurements with 50% weight assigned to income in order to highlight its importance.

Alkire-Foster Results

For brevity, this labor compliance application of the Alkire-Foster method focuses on three population subdivisions of interest identified in section 3.3: education level, firm size, and urban or non-urban residence. Table 15 presents violation frequency for all six compliance

measures. The final column shows frequency of violating two or more dimensions, or the headcount value H, for each subdivision. While adding two additional dimensions increases the severity of headcount measures, violation patterns in table 15 follow the patterns discussed in section 3. Table 16 shows the Alkire-Foster results. The first variable of interest is the headcount percentage (column 4), which represents the fraction of workers that experience two or more violations contributed by each segmentation. This measurement allows us to account for both violation rates and total members of a particular segmentation. The results suggest a reevaluation of firm size and urban rural segmentations. Although analysis in part 3 showed firms with only one employee caused the steepest violations, a majority of workers facing two or more violations are employed by firms with 2 to 9 people. Additionally, rural workers, who experienced the steepest violation rates, only constitute 7.6% of workers facing more than 2 violations, compared to the 53.7% contribution rate from workers in urban areas with populations larger than 5,000 people. In terms of policy relevance, the Uruguayan government should focus on reducing violation incidences among groups with both steep violation rates and large percentage contribution rates. The other variables of interest presented in Table 16 are M_0^a and M_0^b. As discussed in the description of methodology, the M value measures both incidence of violation and depth of violation. Two interesting observations are made. First, we see that, while the M_0^a and M_0^b values for workers in single person firms and for rural workers are the highest in their respective segmentation groups, as was true for the headcount measurement. This implies that workers in groups with high headcount ratios also experience violation in a high percentage of dimensions. Second, for each case, the value of the M_0^a is greater than the value of the M_0^b

measurement. This suggests that minimum wage infraction is not a strong contributor to experiencing violation in two or more dimensions.

Enforcement Resources

Variation in labor law violation rates between urban and rural workers and between workers in Montevideo and workers in states at the border with Brazil and Argentina provide a foundation for further analysis on the relationship between labor law violation and enforcement resources. As discussed in the literature review, Ronconi uses Argentine data to estimate the effect of enforcement on compliance, using the number of labor inspectors per capita as the explanatory variable and democratic regimes to instrument for endogeneity. Labor inspectors per capita may be endogenous to a model estimating compliance due to a reverse causality, where low compliance invites more inspectors and more inspectors increases pressure to comply. The strong similarities between Argentine and Uruguayan political cultures and geographic evidence from the identification exercise suggest that replication of the study could reinforce the significance enforcement resources plays in determining compliance levels.

Informality of worker

A final potentially interesting research topic is identification of the relationship between labor law violations and informality. Initial intuition leads one to think that informal firms have no incentive to provide labor rights mandated by the government, since informal firms operate without government recognition. Another school of thought suggests that informal firms are incentivized to provide workers with legal labor standards to compete with other informal firms and as a mechanism to avoid being detected by the government.

Conclusion

This paper set out to, first, identify labor law violation rates for the case of Uruguay, second, to extend the study using a variant of the Alkire-Foster multidimensional poverty measurement model and, third, to suggest a research agenda based on the findings. From the identification exercise, we observe three major findings: 1) labor law violation has progressively decreased since 2002 2) black, female, and young laborers who have low education, live in rural areas, and work in small firms are most likely to face at least one labor violation and 3) rural regions and regions near the border of Uruguay have higher violation rates than Montevideo. Alkire – Foster analysis provides two findings relevant to policymakers: 1) percentage contribution measurement accounts for both violation rates and total members of a segmentation, allowing for targeting of deprived populations and 2) the M value, which measures both incidence of violation and depth of violation, allows for identification of labor market segmentations that experience the steepest labor law violations.

APPENDIX

Table 1: Descriptive Statistics 2002 Data

	All	obs	IF	obs	F	obs	Diff	P Val
female	.385	(5510)	.387	(3720)	.381	(1790)	.006	.663
hh head	.443	(5510)	.423	(3720)	.482	(1790)	-.058	.000
married	.462	(5510)	.438	(3720)	.510	(1790)	-.071	.000
urban	.723	(5468)	.698	(3695)	.772	(1773)	-.074	.000
assault	.171	(5510)	.152	(3720)	.209	(1790)	-.056	.000
age								
15 - 21	.200	(5504)	.228	(3718)	.143	(1786)	.084	.000
21 - 30	.225	(5504)	.214	(3718)	.246	(1786)	-.023	.007
30 - 41	.190	(5504)	.185	(3718)	.200	(1786)	-.015	.172
41 - 54	.196	(5504)	.182	(3718)	.227	(1786)	-.045	.000
$>$ 54	.186	(5504)	.189	(3718)	.181	(1786)	.008	.464
education								
$<$ Prim	.167	(5495)	.196	(3710)	.108	(1785)	.087	.000
Primary	.241	(5495)	.255	(3710)	.212	(1785)	.042	.001
Secondary	.355	(5495)	.346	(3710)	.373	(1785)	-.026	.054
High School	.113	(5495)	.096	(3710)	.146	(1785)	-.050	.000
College	.122	(5495)	.105	(3710)	.158	(1785)	-.053	.000
job type								
Blue Collar	.410	(5481)	.416	(3701)	.395	(1780)	.021	.131
Wht Collar	.383	(5481)	.350	(3701)	.451	(1780)	-.100	.000
Service	.207	(5481)	.232	(3701)	.153	(1780)	.079	.000
income group								
Lower	.333	(5223)	.360	(3505)	.277	(1718)	.083	.000
Middle	.347	(5223)	.364	(3505)	.314	(1718)	.049	.000
Upper	.318	(5223)	.275	(3505)	.408	(1718)	-.132	.000
firm size								
5 or Less	.422	(5274)	.517	(3598)	.219	(1676)	.297	.000
6 - 50	.409	(5274)	.361	(3598)	.513	(1676)	-.151	.000
51 - 250	.105	(5274)	.080	(3598)	.159	(1676)	-.079	.000
251 or More	.061	(5274)	.040	(3598)	.107	(1676)	-.067	.000

Table 2: Descriptive Statistics 2005 Data

	All	obs	IF	obs	F	obs	Diff	P Val
female	.376	(5249)	.378	(3390)	.373	(1859)	.005	.712
hh head	.416	(5249)	.397	(3390)	.449	(1859)	-.052	.000
married	.453	(5249)	.422	(3390)	.509	(1859)	-.087	1.19
urban	.729	(5188)	.699	(3357)	.784	(1831)	-.085	2.92
assault	.112	(5202)	.100	(3356)	.134	(1846)	-.034	.000
age								
15 - 21	.221	(5195)	.252	(3355)	.164	(1840)	.087	2.76
21 - 30	.206	(5195)	.201	(3355)	.216	(1840)	-.014	.216
30 - 41	.190	(5195)	.171	(3355)	.224	(1840)	-.052	4.04
41 - 54	.186	(5195)	.176	(3355)	.205	(1840)	-.028	.011
$>$ 54	.194	(5195)	.197	(3355)	.189	(1840)	.007	.491
education								
$<$ Prim	.161	(5160)	.192	(3327)	.105	(1833)	.086	4.32
Primary	.240	(5160)	.263	(3327)	.199	(1833)	.063	3.02
Secondary	.358	(5160)	.342	(3327)	.386	(1833)	-.043	.001
High School	.128	(5160)	.107	(3327)	.166	(1833)	-.059	8.45
College	.110	(5160)	.093	(3327)	.141	(1833)	-.047	1.86
job type								
Blue Collar	.417	(5156)	.447	(3323)	.362	(1833)	.085	2.68
Wht Collar	.394	(5156)	.338	(3323)	.494	(1833)	-.155	4.11
Service	.188	(5156)	.213	(3323)	.143	(1833)	.070	6.62
income group								
Lower	.362	(4828)	.442	(3108)	.217	(1720)	.225	3.52
Middle	.311	(4828)	.306	(3108)	.321	(1720)	-.014	.285
Upper	.325	(4828)	.250	(3108)	.461	(1720)	-.210	1.31
firm size								
5 or Less	.465	(4786)	.573	(3156)	.256	(1630)	.317	5.8e
6 - 50	.396	(4786)	.342	(3156)	.500	(1630)	-.157	2.53
51 - 250	.083	(4786)	.053	(3156)	.142	(1630)	-.088	4.37
251 or More	.054	(4786)	.030	(3156)	.101	(1630)	-.070	8.90

Table 3: Descriptive Statistics 2009 Data

	All	obs	IF	obs	F	obs	Diff	P Val
female	.386	(6051)	.382	(3619)	.391	(2432)	-.008	.513
hh head	.376	(6067)	.363	(3631)	.396	(2436)	-.032	.010
married	.447	(6067)	.412	(3631)	.500	(2436)	-.087	.000
urban	.627	(5913)	.595	(3557)	.676	(2356)	-.080	.000
assault	.078	(3780)	.080	(2122)	.077	(1658)	.002	.741
age								
15 - 21	.217	(6002)	.267	(3591)	.144	(2411)	.122	.000
21 - 30	.206	(6002)	.191	(3591)	.228	(2411)	-.036	.000
30 - 41	.177	(6002)	.151	(3591)	.215	(2411)	-.063	.000
41 - 54	.202	(6002)	.182	(3591)	.232	(2411)	-.050	.000
/sym¿ 54	.195	(6002)	.207	(3591)	.178	(2411)	.028	.006
education								
< Prim	.141	(5988)	.179	(3580)	.086	(2408)	.092	.000
Primary	.225	(5988)	.264	(3580)	.168	(2408)	.096	.000
Secondary	.367	(5988)	.360	(3580)	.377	(2408)	-.017	.166
High School	.151	(5988)	.117	(3580)	.202	(2408)	-.085	.000
College	.113	(5988)	.078	(3580)	.164	(2408)	-.086	.000
job type								
Blue Collar	.244	(5439)	.224	(3284)	.275	(2155)	-.051	.000
Wht Collar	.513	(5439)	.490	(3284)	.547	(2155)	-.057	.000
Service	.242	(5439)	.285	(3284)	.176	(2155)	.108	.000
income group								
Lower	.340	(5211)	.431	(3146)	.200	(2065)	.231	.000
Middle	.382	(5211)	.383	(3146)	.380	(2065)	.003	.825
Upper	.277	(5211)	.184	(3146)	.418	(2065)	-.234	.000
firm size								
5 or Less	.485	(5751)	.630	(3506)	.259	(2245)	.371	.000
6 - 50	.388	(5751)	.318	(3506)	.497	(2245)	-.178	.000
51 - 250	.077	(5751)	.035	(3506)	.142	(2245)	-.107	.000
251 or More	.048	(5751)	.015	(3506)	.100	(2245)	-.084	.000

Table 4: Khamis Social Security Probit Replication

	Khamis 2005	Replication 2002	Replication 2005	Replication 2009
female	-0.039	0.056	0.063	0.013
	(0.06)	(0.045)	(0.052)	(0.044)
age	0.006*	0.007***	0.009***	0.011***
	(0.003)	(0.002)	(0.002)	(0.002)
household head	0.043	0.121**	0.088	-0.007
	(0.071)	(0.051)	(0.061)	(0.048)
married	0.197**	0.078	0.177**	0.148***
	(0.095)	(0.064)	(0.077)	(0.057)
single	0.129	-0.047	-0.001	-0.135**
	(0.098)	(0.070)	(0.080)	(0.062)
divorced	0.16	0.004	0.003	0.148
	(0.131)	(0.092)	(0.111)	(0.090)
primary edu.	0.359**	0.283**	0.257**	-0.117
	(0.158)	(0.113)	(0.127)	(0.104)
Secondary	0.629***	0.579***	0.590***	0.399***
	(0.156)	(0.114)	(0.125)	(0.101)
tertiary	0.591***	0.664***	0.665***	0.712***
	(0.164)	(0.124)	(0.139)	(0.116)
ability	0.019*	0.012*	0.027***	0.022***
	(0.010)	(0.007)	(0.009)	(0.008)
Observations	5319	3595	4585	

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table 5: Changing the Original Specifications

	A MxFLS-1	B MxFLS-1	C MxFLS-1	A MxFLS-2	B MxFLS-2	C MxFLS-2	A MxFLS-3	B MxFLS-3	C MxFLS-3
female	0.022	0.004	0.084	-0.003	-0.011	-0.024	-0.073*	-0.068*	0.129**
	(0.043)	(0.045)	(0.054)	(0.046)	(0.045)	(0.057)	(0.038)	(0.040)	(0.053)
age	0.052***	0.055***	0.060***	0.041***	0.043***	0.045***	0.094***	0.091***	0.093***
	(0.008)	(0.009)	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.010)
agesq	-0.001***	-0.001***	-0.001***	-0.000***	-0.000***	-0.000***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
hh head	0.105**	0.110**	0.039	0.066	0.073	0.044	0.025	0.032	0.006
	(0.049)	(0.050)	(0.057)	(0.048)	(0.050)	(0.055)	(0.042)	(0.043)	(0.048)
married	0.041	0.075*	0.183***	0.127***	0.095**	0.142**	0.107***	0.104***	0.171***
	(0.042)	(0.044)	(0.058)	(0.042)	(0.044)	(0.057)	(0.038)	(0.040)	(0.054)
urban		0.117***	0.108**		0.209***	0.196***		0.261***	0.268***
		(0.043)	(0.044)		(0.045)	(0.045)		(0.040)	(0.042)
fem× mar			-0.262***			-0.127			-0.204**
			(0.089)			(0.090)			(0.082)
education									
< Element.	-0.455***	-0.448***	-0.425***	-0.551***	-0.468***	-0.419***	-0.550***	-0.513***	-0.486***
	(0.060)	(0.063)	(0.065)	(0.062)	(0.065)	(0.066)	(0.060)	(0.062)	(0.066)
Elementary	-0.187***	-0.193***	-0.179***	-0.303***	-0.281***	-0.244***	-0.362***	-0.357***	-0.355***
	(0.048)	(0.050)	(0.051)	(0.049)	(0.051)	(0.052)	(0.046)	(0.048)	(0.051)
High School	0.150**	0.182***	0.190***	0.212***	0.276***	0.211***	0.323***	0.320***	0.348***
	(0.060)	(0.061)	(0.062)	(0.058)	(0.060)	(0.061)	(0.051)	(0.053)	(0.057)
College	0.093	0.056	0.090	0.165***	0.187***	0.096	0.400***	0.376***	0.424***
	(0.060)	(0.063)	(0.063)	(0.064)	(0.067)	(0.067)	(0.058)	(0.061)	(0.065)
job type									
Wht Collar			0.025			0.253***			-0.219***
			(0.049)			(0.050)			(0.047)
Service			-0.246***			-0.087			-0.445***
			(0.055)			(0.059)			(0.058)
Observations	5450	5409	5397	5097	5041	5027	5947	5802	5206

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table 7: Income Extension

	Lower 2002	Middle 2002	Upper 2002	Lower 2005	Middle 2005	Upper 2005	Lower 2009	Middle 2009	Upper 2009
female	0.016	0.259***	0.222**	0.006	0.164*	0.087	0.018	0.351***	0.440***
	(0.091)	(0.094)	(0.102)	(0.102)	(0.093)	(0.116)	(0.097)	(0.092)	(0.103)
age	0.070***	0.042***	0.024	0.036**	0.023*	0.035*	0.096***	0.059***	0.049***
	(0.015)	(0.015)	(0.017)	(0.015)	(0.013)	(0.019)	(0.016)	(0.016)	(0.018)
agesq	-0.001***	-0.000**	-0.000	-0.000**	-0.000	-0.000	-0.001***	-0.001***	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
hh head	0.129	-0.028	0.039	0.033	-0.053	0.048	-0.073	-0.012	0.051
	(0.100)	(0.102)	(0.093)	(0.105)	(0.089)	(0.095)	(0.094)	(0.078)	(0.078)
married	0.074	0.305***	0.166*	0.367***	0.143	0.018	0.192*	0.153*	0.125
	(0.104)	(0.106)	(0.092)	(0.114)	(0.090)	(0.098)	(0.110)	(0.084)	(0.085)
urban	0.107	0.011	-0.052	0.133*	0.185**	0.139	0.314***	0.221***	0.096
	(0.074)	(0.076)	(0.087)	(0.078)	(0.074)	(0.093)	(0.076)	(0.071)	(0.080)
fem× mar	-0.193	-0.401**	-0.214	-0.403**	-0.199	-0.101	-0.235	-0.144	-0.372**
	(0.158)	(0.156)	(0.151)	(0.167)	(0.149)	(0.162)	(0.153)	(0.136)	(0.147)
education									
< Element.	-0.363***	-0.453***	-0.349***	-0.430***	-0.310***	-0.368**	-0.456***	-0.300***	-0.510***
	(0.113)	(0.111)	(0.126)	(0.114)	(0.107)	(0.144)	(0.117)	(0.103)	(0.153)
Elementary	-0.086	-0.219**	-0.227**	-0.224**	-0.164**	-0.197*	-0.413***	-0.233***	-0.299***
	(0.088)	(0.087)	(0.095)	(0.094)	(0.079)	(0.109)	(0.094)	(0.081)	(0.105)
High School	0.307***	0.011	0.133	0.009	0.206*	0.309***	0.208*	0.247**	0.339***
	(0.119)	(0.113)	(0.093)	(0.116)	(0.105)	(0.102)	(0.110)	(0.098)	(0.093)
College	0.220*	0.101	-0.003	-0.224	-0.140	0.222**	0.169	0.216*	0.416***
	(0.121)	(0.111)	(0.089)	(0.137)	(0.127)	(0.095)	(0.135)	(0.119)	(0.087)
job type									
Wht Collar	0.057	0.020	-0.004	0.187**	0.227***	0.190**	-0.342***	-0.223***	-0.162*
	(0.088)	(0.085)	(0.082)	(0.094)	(0.078)	(0.092)	(0.089)	(0.075)	(0.092)
Service	-0.133	-0.302***	-0.177	-0.186*	-0.014	0.028	-0.550***	-0.368***	-0.101
	(0.093)	(0.093)	(0.109)	(0.110)	(0.095)	(0.120)	(0.106)	(0.093)	(0.118)
Observations	1834	1838	1842	1770	1864	1578	1801	1875	1806

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table 8: Firm Size Extension

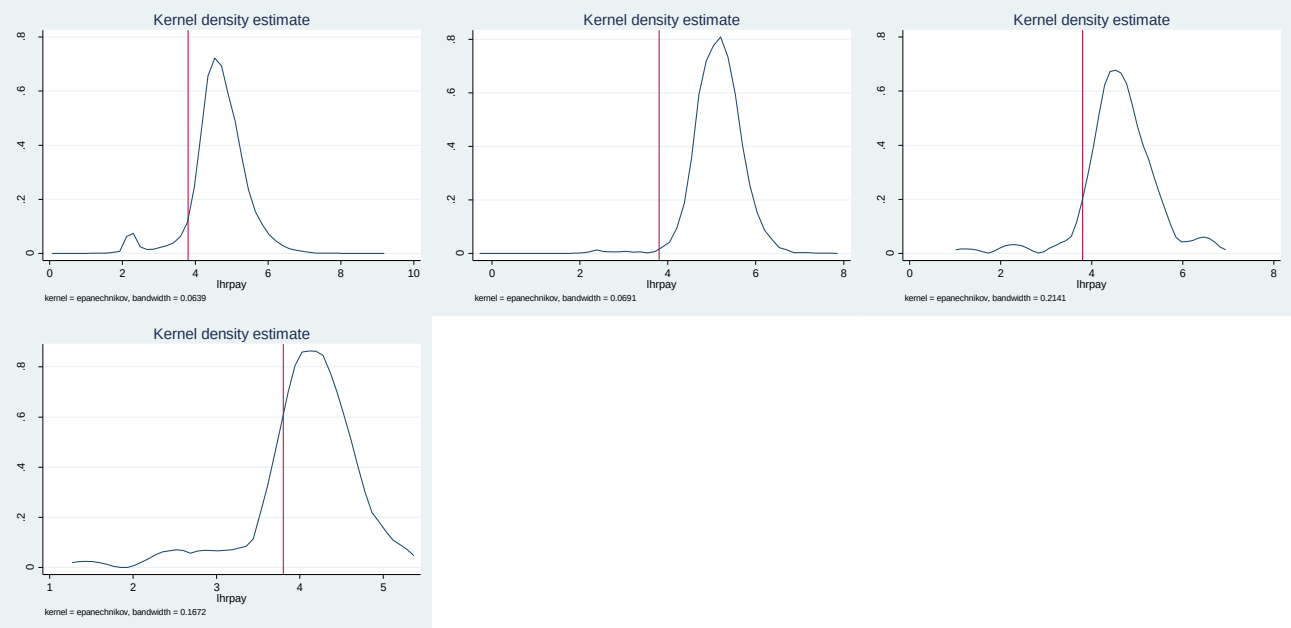
	5 or Less 2002	6 - 50 2002	51 or More 2002	5 or Less 2005	6 - 50 2005	51 or More 2005	5 or Less 2009	6 - 50 2009	51 or More 2009
female	-0.087	0.108	0.213	-0.286***	0.078	0.257	0.095	0.246***	0.166
	(0.107)	(0.085)	(0.134)	(0.109)	(0.093)	(0.162)	(0.094)	(0.087)	(0.167)
age	0.068***	0.047***	0.057**	0.066***	0.064***	0.015	0.080***	0.096***	0.073**
	(0.016)	(0.015)	(0.022)	(0.014)	(0.015)	(0.028)	(0.014)	(0.016)	(0.030)
agesq	-0.001***	-0.001***	-0.001**	-0.001***	-0.001***	-0.000	-0.001***	-0.001***	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
hh head	-0.030	0.086	-0.048	0.069	-0.034	0.072	0.058	0.050	0.010
	(0.104)	(0.089)	(0.135)	(0.101)	(0.090)	(0.168)	(0.079)	(0.077)	(0.150)
married	0.282**	0.047	0.191	0.204*	0.091	0.065	0.162*	0.091	0.040
	(0.115)	(0.086)	(0.137)	(0.106)	(0.093)	(0.174)	(0.093)	(0.084)	(0.163)
urban	0.082	0.101	-0.011	0.034	0.266***	0.062	0.235***	0.293***	0.025
	(0.079)	(0.070)	(0.113)	(0.077)	(0.077)	(0.138)	(0.071)	(0.069)	(0.135)
fem× mar	-0.355**	-0.049	-0.464**	-0.203	-0.017	-0.115	-0.161	-0.056	-0.361
	(0.163)	(0.140)	(0.223)	(0.159)	(0.149)	(0.281)	(0.136)	(0.134)	(0.274)
education									
< Element.	-0.316***	-0.295***	-0.141	-0.501***	-0.146	-0.307	-0.492***	-0.592***	0.310
	(0.115)	(0.106)	(0.181)	(0.115)	(0.116)	(0.205)	(0.106)	(0.115)	(0.259)
Elementary	-0.207**	-0.122	0.007	-0.193**	-0.099	-0.143	-0.418***	-0.257***	-0.331**
	(0.094)	(0.080)	(0.121)	(0.094)	(0.087)	(0.149)	(0.087)	(0.083)	(0.157)
High School	0.152	0.093	0.171	0.293***	0.198**	0.356**	0.405***	0.216**	0.139
	(0.119)	(0.094)	(0.148)	(0.110)	(0.099)	(0.178)	(0.095)	(0.090)	(0.165)
College	0.117	-0.039	0.061	0.292**	-0.088	0.099	0.480***	0.240**	0.261
	(0.123)	(0.093)	(0.147)	(0.123)	(0.104)	(0.188)	(0.109)	(0.098)	(0.205)
job type									
Wht Collar	0.422***	0.111	-0.119	0.693***	0.343***	-0.217*	-0.038	-0.076	-0.025
	(0.094)	(0.075)	(0.121)	(0.099)	(0.082)	(0.128)	(0.086)	(0.077)	(0.132)
Service	0.034	-0.019	-0.200	0.273**	0.142	-0.381**	-0.271**	-0.228**	0.141
	(0.109)	(0.088)	(0.138)	(0.117)	(0.097)	(0.184)	(0.107)	(0.096)	(0.177)
Observations	2187	2125	861	2126	1811	623	2408	1919	621

Standard errors in parentheses

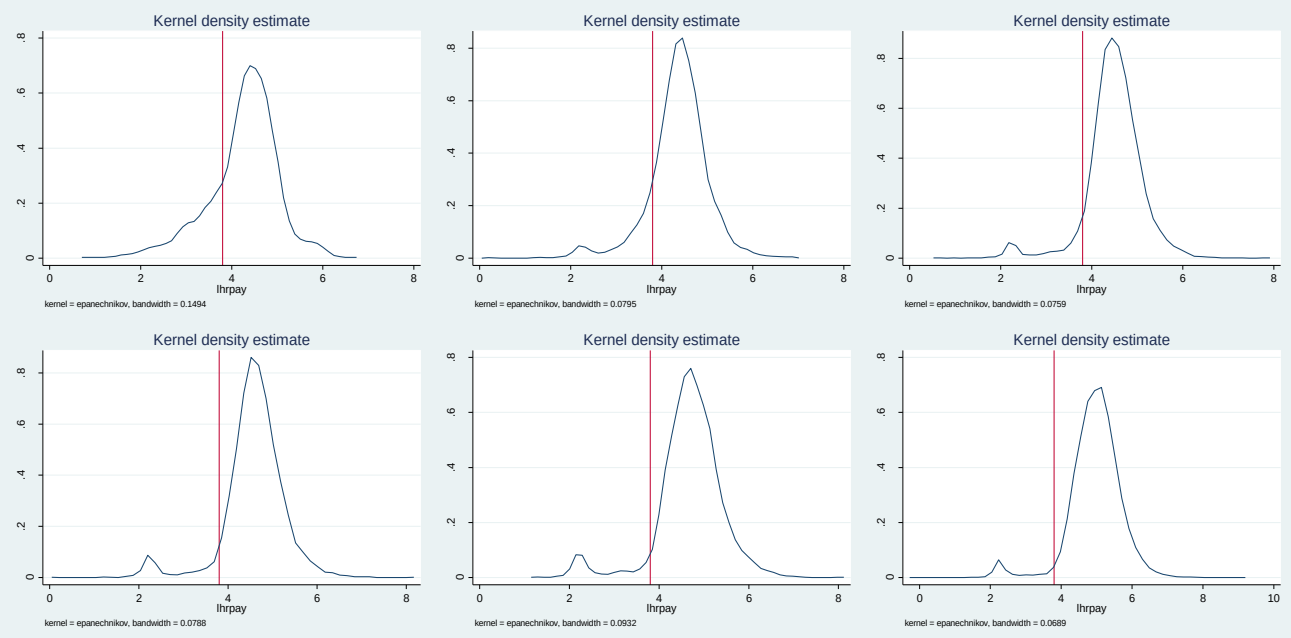
* p<0.1, ** p<0.05, *** p<0.01

Kernel Densities

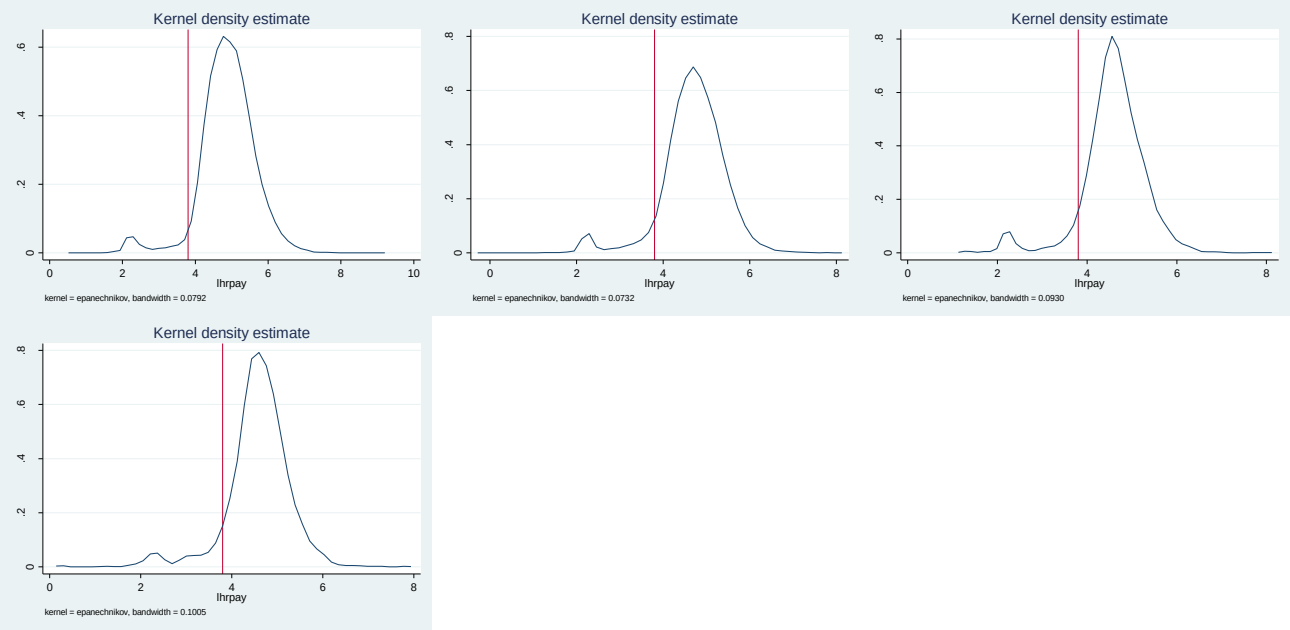
By job type



By size of firm



By region



By Education Level

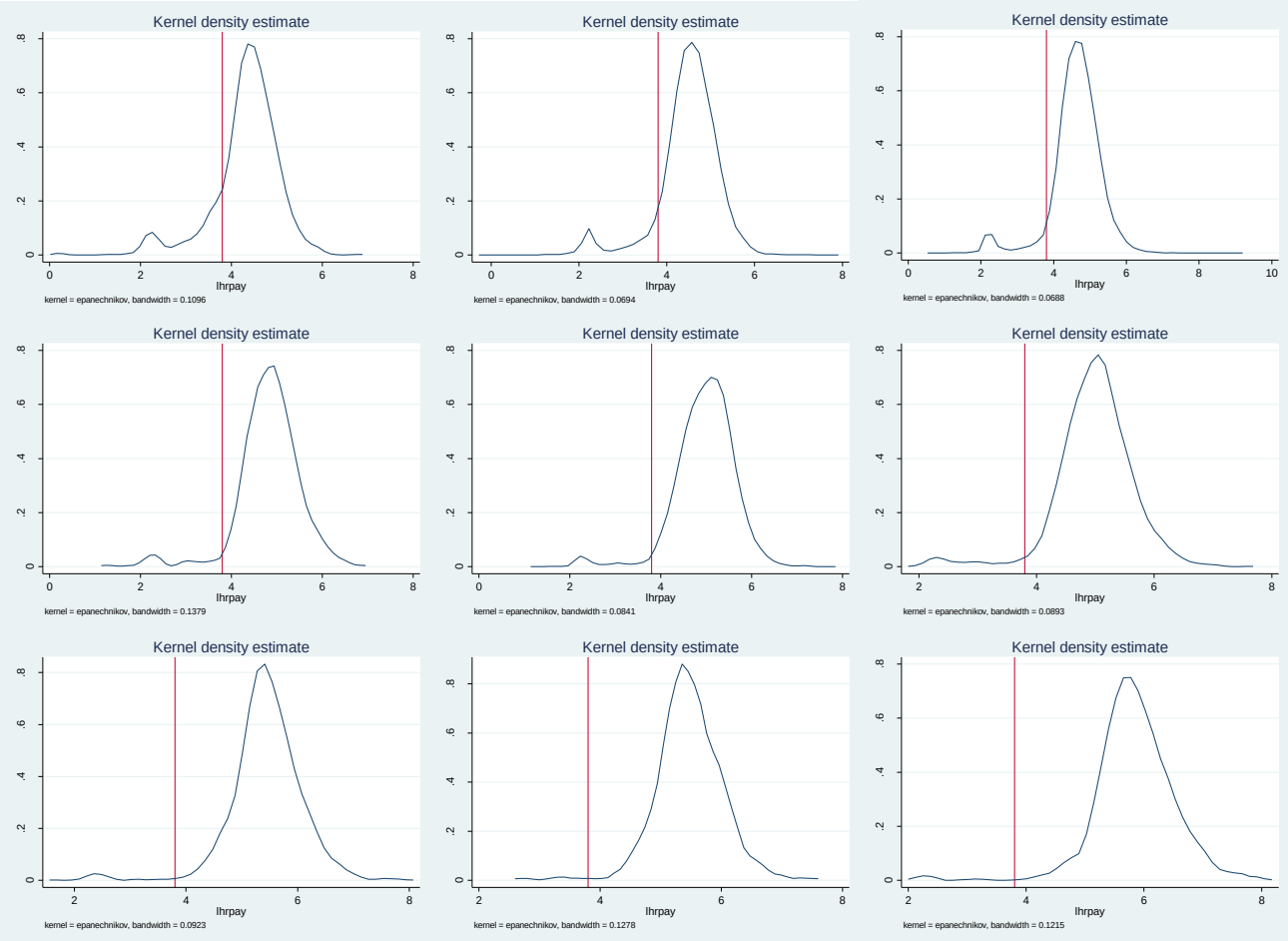


Table 11

Year	V_0	V_1	V_1/V_0	Hours	Agui	Soc	≥1
2014	.062	.032	.512	.019	.071	.084	.142
2013	.066	.034	.517	.126*	.073	.085	.137*
2012	.074	.035	.465	.134*	.080	.097	.150*
2011	.045	.023	.508	.114*	.150	.101	.158*
2010	.066	.029	.431	.169*	.100	.117	.167*
2009	.069	.028	.407	.179*	.101	.128	.172*
2008	.058	.024	.423	.192*	.118	.138	.182*
2007	.063	.024	.382	.196*	.132	.154	.199*
2005	.047	.014	.309	.166	.207	.232	.252*
2002	.028	.008	.306	.166*	.181	.210	.236*

Table 12

Categorization	V_0	V_1	V_1/V_0	Hours	Agui	Soc	≥1
Age							
18 - 25	.112	.054	.482	.018	.130	.154	.237
25 - 40	.056	.029	.517	.017	.056	.066	.123
40 - 65	.046	.024	.522	.020	.051	.061	.111
65 +	.129	.050	.388	.038	.279	.351	.378
Gender							
Female	.068	.036	.529	.010	.058	.073	.129
Male	.057	.029	.508	.027	.081	.093	.153
Education							
Primary – incomplete	.156	.068	.436	.059	.266	.298	.388
Primary	.095	.046	.484	.029	.120	.144	.221
Liceo Basico	.066	.035	.530	.017	.062	.078	.141
Liceo Tecnico	.043	.026	.605	.008	.031	.033	.082
Liceo Segundario	.030	.017	.567	.011	.024	.027	.065
Univ. incomplete	.035	.020	.571	.007	.038	.041	.082
University	.016	.010	.625	.009	.013	.012	.041
Grad. incomplete	.009	.004	.444	.018	.015	.015	.042
Graduate	.009	.006	.667	.015	.015	.008	.039
Residence upon birth							
Current residence	.064	.033	.516	.018	.072	.086	.144
Dif. residence in dep.	.071	.036	.507	.027	.093	.108	.168
Dif. department	.052	.028	.538	.018	.056	.067	.123
Dif. Country	.066	.034	.515	.034	.099	.107	.186
Ethnicity							
Black	.113	.055	.487	.028	.112	.135	.217
Asian	.031	.015	.484	.000	.125	.031	.156
White	.060	.031	.517	.019	.068	.081	.138
Native	.079	.037	.468	.025	.098	.117	.184

Table 13

Categorization	V_0	V_1	V_1/V_0	Hours	Agu	Soc	≥1
Job Type							
Private employers	.078	.040	.512	.025	.091	.110	.181
Public employers	.012	.007	.583	>.000	.000	.000	.012
Cooperative employment	.066	.036	.545	.000	.253	.022	.286
Social program employ.	.193	.071	.368	.000	.422	.048	.470
Firm Size							
1 person	.214	.091	.425	.040	.322	.461	.500
2 to 4 people	.134	.050	.373	.051	.292	.349	.424
5 to 9 people	.074	.033	.446	.033	.135	.168	.236
10 to 19 people	.068	.024	.353	.029	.071	.078	.157
20 to 49 people	.067	.037	.522	.021	.041	.040	.121
50 or more people	.039	.039	1	.007	.008	.008	.054

Table 14

Categorization	V_0	V_1	V_0/V_1	Hours	Agui	Soc	≥1
Department							
Montevideo	0.046	.026	.568	.014	.041	.051	.102
Artigas	0.115	.052	.446	.032	.153	.182	.244
Canelones	0.073	.040	.545	027	.074	.086	.159
Cerro Largo	0.072	.030	.423	.011	.147	.158	.202
Colonia	0.056	.032	.572	.021	.061	.079	.143
Durazno	0.073	.037	.507	.021	.062	.072	.138
Flores	0.056	.025	.441	.017	.088	.096	.150
Florida	0.073	.029	.401	.018	.102	.104	.160
Lavalleja	0.063	.028	.447	.024	.074	.097	.150
Maldonado	0.066	.043	.647	.004	.057	.058	.124
Paysandu	0.055	.029	.521	.016	.077	.098	.152
Rio Negro	0.074	.032	.439	.008	.063	.092	.143
Rivera	0.117	.044	.374	.039	.150	.167	.230
Rocha	0.069	.028	.403	.033	.119	.138	.190
Salto	0.082	.035	.429	.016	.126	.156	.214
San Jose	0.073	.038	.517	.037	.101	.123	.194
Soriano	0.066	.028	.420	.014	.109	.125	.183
Tacuarembo	0.091	.033	.365	.027	.128	.156	.207
Treinta y Tres	0.084	.033	.390	.034	.116	.139	.199
Urban - Rural							
Montevideo	.046	.026	.568	.014	.041	051	.102
Urban – 5,000 +	.072	.035	.490	.019	.085	.102	.161
Urban – 5,000 or less	.080	.039	.486	.026	.120	.134	.206
Rural	.085	.039	.458	.053	.122	.136	.220

Table 15

Categorization	V_0	Hours	Aguis	Soc	Extra	Vaca	≥1	≥2 (H)
Firm Size								
1 person	.214	.091	.322	.461	.303	.410	.571	.436
2 to 4 people	.134	.050	.292	.349	.255	.342	.502	.375
5 to 9 people	.074	.033	.135	.168	.163	.166	.314	.190
10 to 19 people	.068	.024	.071	.078	.133	.096	.243	.109
20 to 49 people	.067	.037	.041	.040	.107	.054	.196	.069
50 or more people	.039	.039	.008	.008	.044	.013	.090	.018
Education								
Primary – incomplete	.156	.059	.266	.298	.231	.299	.444	.332
Primary	.095	.029	.120	.144	.131	.149	.274	.165
Liceo Basico	.066	.017	.062	.078	.093	.077	.194	.091
Liceo Tecnico	.043	.008	.031	.033	.033	.035	.097	.039
Liceo Segundario	.030	.011	.024	.027	.069	.036	.115	.042
Univ. incomplete	.035	.007	.038	.041	.090	.050	.154	.053
University	.016	.009	.013	.012	.074	.019	.105	.026
Grad. incomplete	.009	.018	.015	.015	.081	.024	.102	.042
Graduate	.009	.015	.015	.008	.096	.017	.119	.031
Urban - Rural								
Montevideo	.046	.014	.041	.051	.089	.056	.164	.065
Urban – 5,000 +	.072	.019	.085	.102	.100	.103	.208	.116
Urban – 5,000 or less	.080	.026	.120	.134	.124	.144	.256	.158
Rural	.085	.053	.122	.136	.193	.148	.305	.185

Table 16

Categorization	Population	Percentage	H	Percentage	M_0^a	M_0^b
Total	*40529*	*100%*	*.100*	*10.0%*	*.071*	*.067*
Firm Size						
1 person	*631*	*1.56*	*.436*	*6.8*	*.269*	*.239*
2 to 4 people	*4978*	*12.28*	*.375*	*45.8*	*.216*	*.172*
5 to 9 people	*4269*	*10.53*	*.190*	*20.0*	*.103*	*.079*
10 to 19 people	*4202*	*10.37*	*.109*	*11.3*	*.057*	*.044*
20 to 49 people	*3619*	*8.93*	*.069*	*6.2*	*.034*	*.027*
50 or more people	*22830*	*56.33*	*.018*	*10.0*	*.008*	*.006*
Education						
Primary – incomplete	*1344*	*3.32*	*.332*	*10.9*	*.199*	*.163*
Primary	*11059*	*27.30*	*.165*	*44.9*	*.093*	*.075*
Liceo Basico	*12568*	*31.02*	*.091*	*28.1*	*.048*	*.039*
Liceo Tecnico	*515*	*1.27*	*.039*	*0.5*	*.021*	*.015*
Liceo Segundario	*7448*	*18.38*	*.042*	*7.7*	*.021*	*.016*
Univ. incomplete	*4036*	*9.96*	*.053*	*5.3*	*.027*	*.020*
University	*2344*	*5.79*	*.026*	*1.5*	*.011*	*.008*
Graduate - incomplete	*332*	*0.82*	*.042*	*0.3*	*.017*	*.011*
Graduate	*868*	*2.14*	*.031*	*0.7*	*.012*	*.008*
Urban - Rural						
Montevideo	*17059*	*42.10*	*.065*	*27.10*	*.033*	*.025*
Urban – 5,000 +	*18789*	*46.36*	*.116*	*53.67*	*.065*	*.053*
Urban – 5,000 or less	*3021*	*7.45*	*.158*	*11.77*	*.089*	*.070*
Rural	*1651*	*4.07*	*.185*	*7.59*	*.103*	*.083*

Table 17

	(1) greater	(2) greater	(3) greater
greater			
age	-0.114***	-0.114***	-0.0962***
	(0.00360)	(0.00360)	(0.00373)
agesq	0.00125***	0.00126***	0.00105***
	(0.0000429)	(0.0000429)	(0.0000443)
school	-0.0763***	-0.0725***	-0.0423***
	(0.00253)	(0.00257)	(0.00269)
gender	0.0430*	0.0470**	0.00587
	(0.0168)	(0.0168)	(0.0182)
black		0.195***	0.215***
		(0.0355)	(0.0382)
bigtown		-0.163***	0.0646*
		(0.0236)	(0.0264)
_cons	1.973***	2.060***	0.689***
	(0.0747)	(0.0762)	(0.0856)
N	40529	40529	40529
pseudo R-sq	0.075	0.078	0.188

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Figure 4

Figure 5

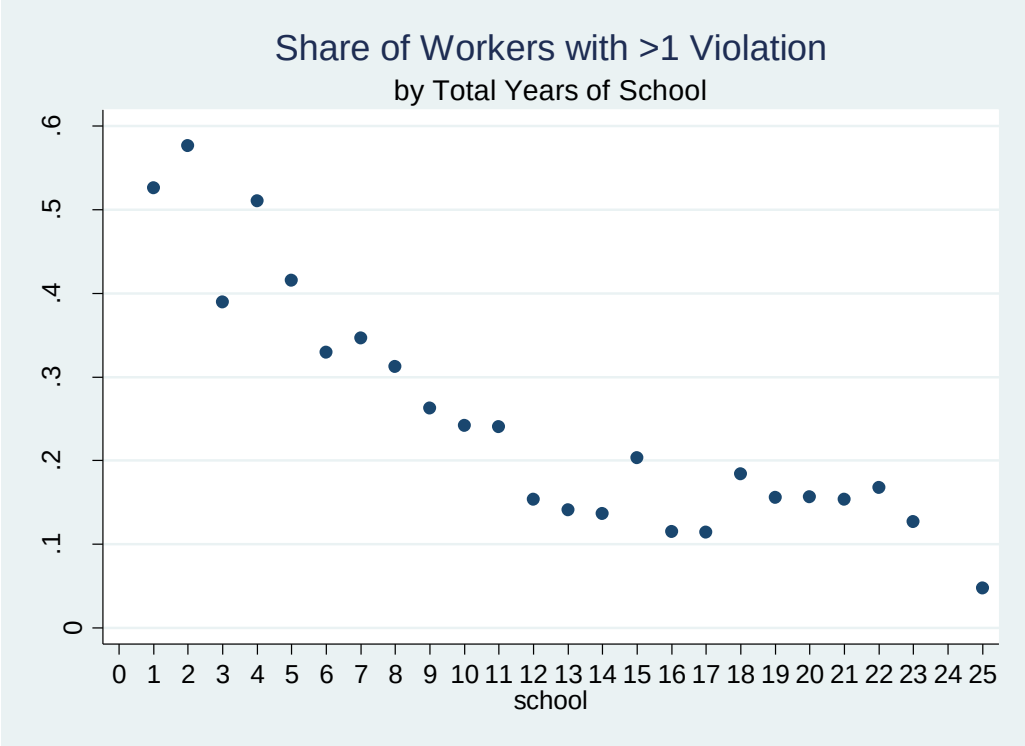
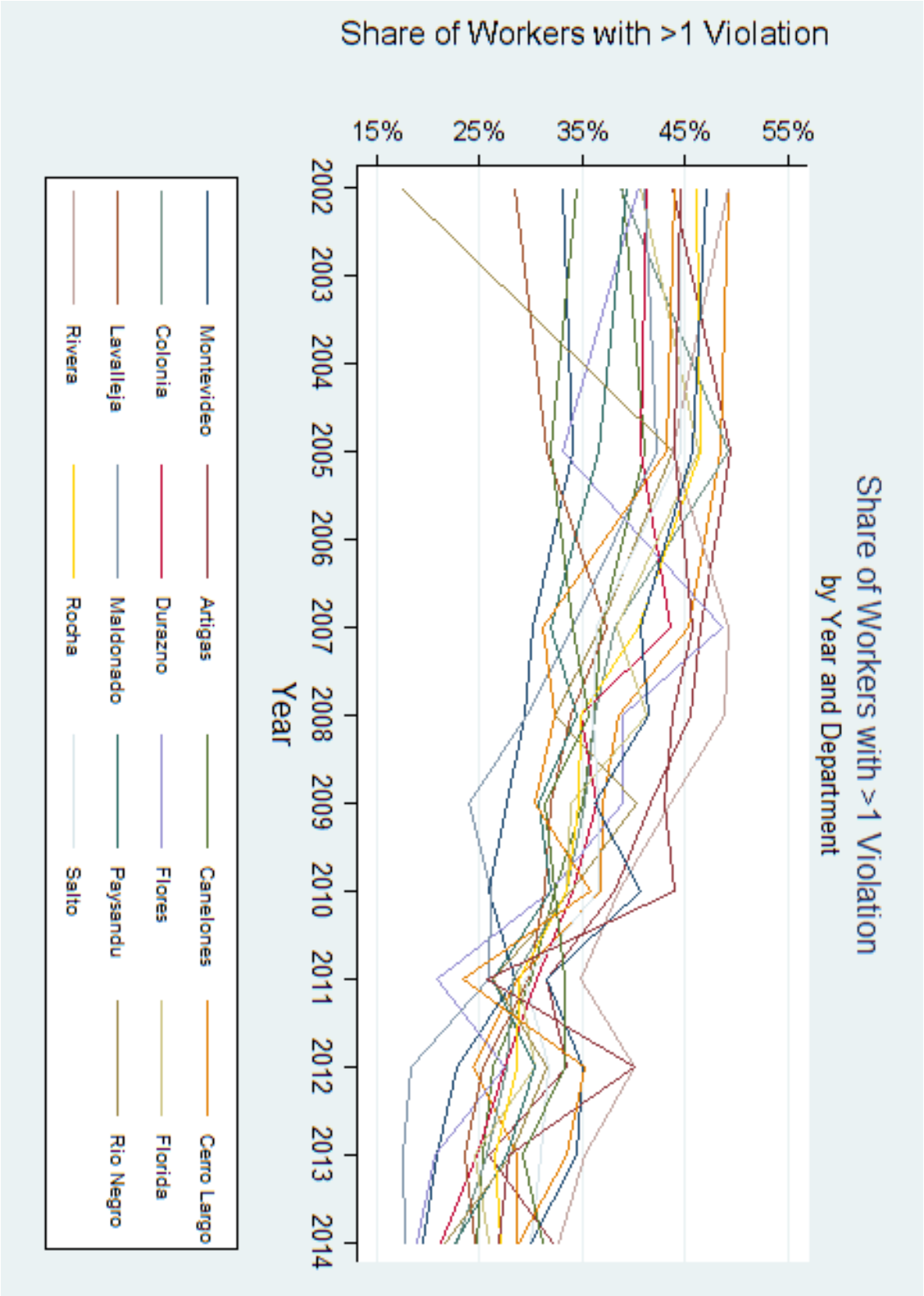


Figure 6


Share of Workers with >1 Violation
by Year and Department
Share of Workers with >1 Violation
15%
25%
35%
45%
55%
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year
Montevideo
Artigas
Canelones
Cerro Largo
Colonia
Durazno
Flores
Florida
Lavalleja
Maldonado
Paysandu
Rio Negro
Rivera
Rocha
Salto

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